CLOTH FROM MOLTEN GLASS—NEW MARVEL OF SCIENCE

MODERN MECHANIX

FEBRUARY 1938

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SPECIAL PHOTOGRAPHY SECTION

A Money-Making Opportunity

for Men of Character

EXCLUSIVE FRANCHISE FOR

AN INVENTION EXPECTED TO REPLACE A MULTI-MILLION-DOLLAR INDUSTRY

Costly Work Formerly "Sent Out" by Business Men Now Done by Themselves at a Fraction of the Expense

This is a call for men everywhere to handle exclusive agency for one of the most unique business inventions of the day.

Forty years ago the horse and buggy business was supreme—today almost extinct. Twenty years ago the phonograph industry ran into many millions—today practically a relic. Only a comparatively few foresighted men saw the fortunes ahead in the automobile and the radio. Yet irresistible waves of public buying swept these men to fortune, and sent the buggy and the phonograph into the discard. So are great successes made by men able to detect the shift in public favor from one industry to another.

Now another change is taking place. An old established industry—an integral and important part of the nation's structure—in which millions of dollars change hands every year—is in thousands of cases being replaced by a truly astonishing, simple invention which does the work better—more reliably—AND AT A COST OFTEN AS LOW AS 25% OF WHAT IS ORDINARILY PAID! It has not required very long for men who have taken over the rights to this valuable invention to do a remarkable business, and show earnings which in these times are almost unheard of for the average man.

Not a "Gadget"— Not a "Knick-Knack"—

but a valuable, proved device which has been sold successfully by business novices as well as seasoned veterans.

Make no mistake—this is no novelty—no flimsy creation which the inventor hopes to put on the market. You probably have seen nothing like it yet—perhaps never dreamed of the existence of such a device—yet it has already been used by corporations of outstanding prominence—by dealers of great corporations—by their branches—by doctors, newspapers, publishers—schools—hospitals, etc., etc., and by thousands of small business men. You don't have to convince a man that he should use an electric bulb to light his office instead of a gas lamp. Nor do you have to sell the same business man the idea that some day he may need something like this invention. The need is already there—the money is usually being spent right at that very moment—and the desirability of saving the greatest part of this expense is obvious immediately.

Some of the Savings You Can Show

You walk into an office and put down before your prospect a letter from a sales organization showing that they did work in their own office for $11 which formerly could have cost them over $200. A building supply corporation pays our man $70, whereas the bill could have been for $1,600! An automobile dealer pays our representative $15, whereas the expense could have been over $1,000. A department store has expense of $88.60, possible cost if done outside the business being well over $2,000. And so on. We could not possibly list all cases here. These are just a few of the many actual cases which we place in your hands to work with. Practically every line of business and every section of the country is represented by these field reports which hammer across dazzling, convincing money-saving opportunities which hardly any business man can fail to understand.

Profits Typical of the Young, Growing Industry

Going into this business is not like selling something offered in every grocery, drug or department store. For instance, when you take a $7.50 order, $5.83 can be your share. On $1,500 worth of business, your share can be $1,167.00. The very least you get as your part of every dollar's worth of business you do is 67 cents—on ten dollars' worth $6.70, on a hundred dollars' worth $67.00—in other words two thirds of every order you get is yours. Not only on the first order—but on repeat orders—and you have the opportunity of earning an even larger percentage.

This Business Has Nothing to Do With House to House Canvassing

Nor do you have to know anything about high-pressure selling. "Selling" is unnecessary in the ordinary sense of the word. Instead of hammering away at the customer and trying to "force" a sale, you make a dignified, business-like call, leave the installation—whatever size the customer says he will accept—at our risk, let the customer sell himself after the device is in and working. This does away with the need for pressure on the customer—it eliminates the handicap of trying to get the money before the customer has really convinced himself 100%. You simply tell what you offer, showing proof of success in that customer's particular line of business. Then leave the invention without a dollar down. It starts working at once. In a few short days, the installation should actually produce enough cash money to pay for the deal, with profits above the investment coming in at the same time. You then call back, collect your money. Nothing is so convincing as our offer to let results speak for themselves without risk to the customer! While others fail to get even a hearing, our men are making sales running into the hundreds. They have received the attention of the largest firms in the country, and sold to the smallest businesses by the thousands.

EARNINGS

One man in California earned over $1,600 per month for three months—close to $5,000 in 90 days' time. Another writes from Delaware—"Since I have been operating (just a little less than a month of actual selling) and not the full day at that, because I have been getting organized and had to spend at least half the day in the office; counting what I have sold outright and on trial, I have made just a little in excess of one thousand dollars profit for one month." A man working small city in N. Y. State made $10,805 in 9 months. Texas man nets over $300 in less than a week's time. Space does not permit mentioning here more than these few random cases. However, they are sufficient to indicate that the worthwhile future in this business is coupled with immediate earnings for the right kind of man. One man with us has already made over a thousand sales on which his earnings ran from $5 to $60 per sale and more. A great deal of this business was repeat business. Yet he had never done anything like this before coming with us. That is the kind of opportunity this business offers. The fact that this business has attracted to it such business men as former bankers, executives of businesses—men who demand only the highest type of opportunity and income—gives a fairly good picture of the kind of business this is. Our door is open, however, to the young man looking for the right field in which to make his start and develop his future.

No Money Need Be Risked

in trying this business out. You can measure the possibilities and not be out a dollar. *If you are looking for a business that is not overcrowded*—a business that is just coming into its own—on the upgrade, instead of the downgrade—a business that offers the buyer relief from a burdensome, but unavoidable expense—a business that has a prospect practically in every office, store, or factory into which you can set foot—regardless of size—*that is a necessity* but does not have any price cutting to contend with as other necessities do—that because you control the sales in exclusive territory is your own business—*that pays more on some individual sales than many men make in a week and sometimes in a month's time*—if such a business looks as if it is worth investigating, *get in touch with us at once* for the rights in your territory—don't delay—because the chances are that if you do wait, someone else will have written to us in the meantime—and if it turns out that you were the better man—we'd both be sorry. So for convenience, *use the coupon below*—but send it right away—or wire if you wish. But do it now. *Address*

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"I know what I am talking about! I'll never forget the time when my child's life was at stake. Not an extra dollar to my name. If it hadn't been for friends. . . .

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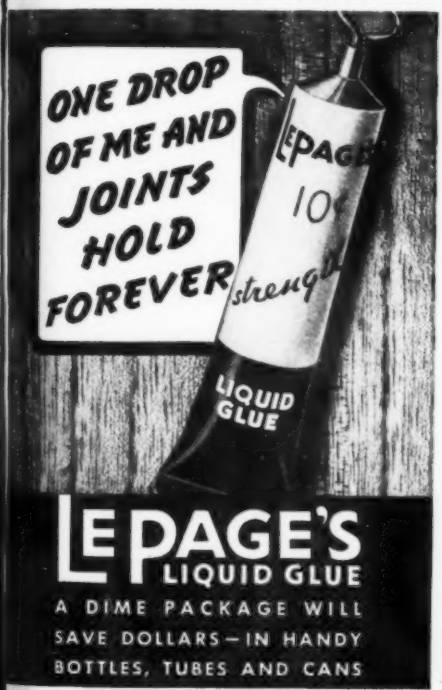

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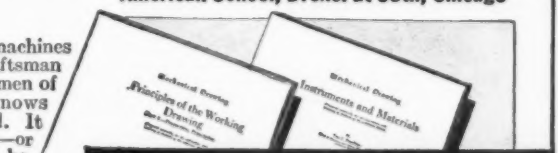

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CEMENT FOR IRON AND MARBLE

My problem is to find a cement that will enable a sheet of iron to be attached to a marble slab. Can you supply me with a simple formula for such a cement?—Walter Johnston, New York, N. Y.

A satisfactory cement for the use you have outlined can be made as follows: 30 parts of Plaster of Paris, 10 parts iron filings, ¼ part sal ammoniac. Mixed with vinegar to form a fluid paste, the adhesive is easily applied to the iron and marble surfaces.

DRILLING HOLES IN GLASS

I am writing you to see if you can supply me with the proper method of drilling small holes in sheet glass. Please advise.—Chester Bush, Anderson, Indiana.

Take any piece of steel wire and file it to the shape of a drill. Hold the drill in a flame until it is a dull red and then quench it in metallic mercury. Thus treated, the steel wire will drill through glass very easily. Lubricate the drill with oil of turpentine while using and when the point of the drill has touched the other side of the glass, place the glass in water and drill very slowly. In making the drill do not make the cutting edges too acute.

MAKING TYPEWRITER RIBBON INK

I am making a toy requiring a typewriter ribbon which I must make myself, due to size. Can you provide me with information as to how to make a good ribbon ink?—Paul Slusher, Plymouth, Pa.

Dissolve ½ ounce of aniline black in 15 ounces of alcohol and add 15 ounces of concentrated glycerine. Apply the ink to the ribbon by means of a soft brush and rub it well into the ribbon with an ordinary toothbrush. Be sure to stir the ink mixture well before applying it to the ribbon.

SOAP FOR CLEANING CARPETS

Can you tell me the name of chemicals which, when mixed, will form a good cleaning fluid for rugs and carpets?—Vincent M. Gantt, Hickory, N. C.

Commercial rug cleaning preparations are available at small cost, but if you desire to make your own the following formula is rated highly: mix 4 ounces of Fuller's earth with 8 ounces of Pearlash and 1 ounce of turpentine. Make into a stiff paste with the consistency of soft soap.

REMOVING FUEL OIL ODOR FROM HANDS

Can you tell me how to remove the odor of light fuel oil from the hands?—James Lawrence, Vancouver, B. C., Canada.

To remove the odor of fuel oil from the hands, wash the hands in a bowl of vinegar. Rub the hands vigorously in the vinegar and then wash off with soap and water.

AIRPLANE PILOT LICENSE EXAMS

Please inform me as to the proper procedure to take in acquiring a student pilot's license. Do I have to have the license before I can take any instruction in aircraft?—Walker Bartlett, Hewlitt, L. I.

The Bureau of Air Commerce regulations concerning the issuance and qualifications for pilot licenses (incidentally they are no longer termed licenses, but "certificates of competency") have been greatly changed within the past few months. Direct your inquiry to the Bureau of Air Commerce at Washington, D. C., or consult the manager of the airport at which you plan to take flying lessons.

MAKING LUMINOUS PAINT

Kindly send me a formula for making a luminous yellow paint.—Alexander Egbert, Philadelphia, Pa.

The following formula will provide a luminous yellow paint: 100 parts (by weight) of strontium carbonate, 20 parts of sulphur, 2 parts of sodium carbonate, 0.5 parts of sodium chloride, 0.2 parts of manganese sulphate. The materials must be heated for about one hour at a temperature of about 2,375 degrees Fahrenheit.

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MEDICINE: Anatomy, circulatory system, nervous system, muscular system, skeletal system, excretory system, etc. Vitamins, hormones. Bacteriology. Diseases—symptoms, diagnosis, treatment. Drugs. Latest researches.

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Flying Sportsman Orders Four-Engined "Aero Yacht"

A LUXURIOUS four-engined "flying yacht" that will probably be the largest privately-owned airplane in the world has been ordered from the Boeing Aircraft Company of Seattle by Captain George Whittell, wealthy sportsman of Woodside, San Mareo County, California.

Of the same design as the four-engined transports being built for both Transcontinental and Western Air and Pan American Airways, but fitted with a special "club style" interior, the giant landplane will have sufficient range to carry its owner and party of guests over any airway in the world. It will cost slightly less than $300,000 and will have the distinction of being the first airplane ever built with a shower bath aboard.

Although the four-engined transport design on which the plane is based will have accommodations for thirty-three passengers, the special "flying yacht" will have its interior divided into commodious suites to carry thirteen persons in roomy luxury, with sleeping accommodations for seven. In addition the plane will carry a crew of three—pilot, co-pilot and mechanic-radioman.

There will be a dining room and lounge, bedrooms for four guests, and a master suite with all the conveniences of home, including hot and cold running water, a radio for program reception and the private shower. There will be a refrigerator in the plane's galley.

As beautiful on the exterior as inside, the plane will have the same sensationally streamlined cylindrical body as the standard Boeing Model 307 four-engined transports being produced for airline operation. It will be an all-metal monoplane with wings measuring 107 feet from tip to tip, with a length of 74 feet, and a gross weight of approximately 41,000 pounds. Power will be supplied by four 1100 horsepower Wright "Cyclone" engines.

The plane will reach a speed of 250 miles per hour and will have a cruising range of approximately 3,300 miles—enough to hop to Europe and make several lengthy side trips on the way. Captain Whittell, who already owns a luxurious twin-engine plane, plans to use his huge new "club special" for world cruises. The plane is now in the engineering stage at the Boeing Company and will be completed late next year.

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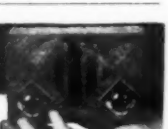

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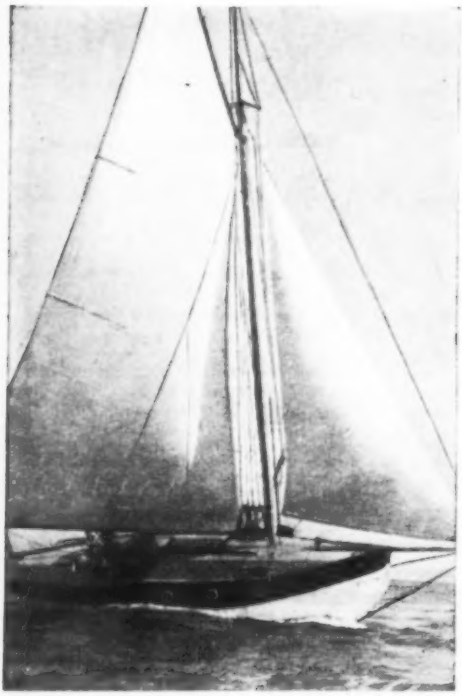


Constructed from MM plans by Charles Nowak, this "Buddy" sailboat presents a pretty picture as it cruises along. Sail area is 300 square feet and mast stands 26 feet high.

A LETTER describing a trim looking boat, constructed from MM plans, won first prize of $5 this month for Charles Nowak, of Milwaukee, Wis. He writes:

Dear Editor:

Enclosed is a photo of "Buddy," which I built from plans in your "How To Build 20 Boats" book. There are three "Buddys" here in Milwaukee, but mine is the fastest. (Proved during races.)

The boat has proved to be a good rough-weather sailor, taking high seas in a very satisfactory manner. I use 400 pounds of ballast and the total weight of the boat is about 2,900 pounds.

Charles Nowak.

We compliment Nowak for the craftsmanship evident in "Buddy's" construction. The photo of the craft under full sail undoubtedly will inspire many other MM readers to construct a boat for use this coming summer.

An award of $3 was sent to Clyde Kempf, of Canton, Ohio, for his letter in which he says:

Dear Editor:

Here is a snapshot of my "Runlite" trailer, which I built from plans appearing in your book "How To Build Trailers." I use the trailer for fishing and hunting trips and find it very practical.

"Runlite" was very easy to build and I have received plenty of compliments on its appearance. Keep running good workshop plans in MM.

Clyde Kempf.

Judging from the photo, Kempf's trailer is well equipped—a veritable "camp on wheels."

* * *

Readers are urged to accompany their letters to the Workbench with clear photos. Many letters received must be rejected for entry in the monthly contest simply because the photos sent with them are poorly taken, preventing reproduction.

* * *

An interesting letter received from Mike Liptak, of St. Paul, Minn., was awarded a $3 prize. He says:

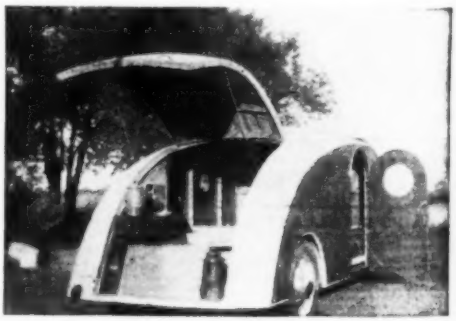
Dear Editor:

Enclosed is a photo of my brother and I holding our five-foot gas model airplane. It represents 100 hours of work.

During a contest we filled the model plane's motor with gasoline and it flew out of sight, but was returned to us the following day. We hope to see more gas model plans in future issues of MM.

Mike Liptak.

Mike sent us a clipping describing the flight during which the gas model airplane was lost and



Fully equipped with camping paraphernalia, this home-built "Runlite" trailer enables Clyde Kempf to make hunting and fishing trips in maximum comfort. MM plans were used.

Editor's Workbench

all we can say is that the model certainly turned out to be a "flying fool," having made more than 40 good flights since its construction.

* * *

Midget racers still appeal to a majority of MM craftsmen and a letter from William Walker, of Akron, Ohio, describing his home-built racer was awarded a prize of $3. The letter reads:

Dear Editor:

I am sending you two photos of my midget racer, which I built from plans in your "How To Build It" book. The car does 40 m.p.h. easily and averages about 40 miles per gallon of gasoline.

My racer is powered with a single cylinder motorcycle engine and boasts a three-speed transmission as well as internal brakes on the rear wheels. I have driven the racer about 500 miles and didn't encounter the slightest trouble.

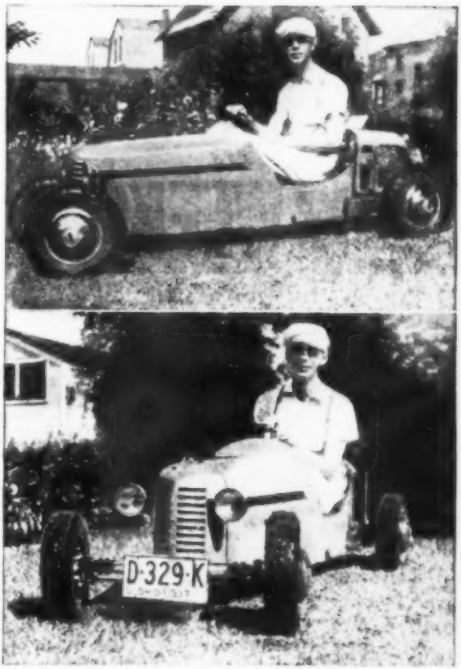
I am a constant reader of MM and enjoy every issue. Your workshop projects are excellent.

William Walker.

Midget racer fans, we are certain, will agree that Walker's tiny car is a "winner" as far as appearance is concerned. Congratulations for a job well done, Walker.

* * *

From far away Australia came a letter written by Donald A. McBean. Awarded a $3 prize, the letter reads:



A speed of 40 m.p.h. and mileage of 40 miles on a gallon of gasoline is claimed for his home-built midget racer (top) by William Walker. Lower photo shows front view of car.

Dear Editor:

You may be interested in the enclosed photo of the good ship "Mayflower," which was built to MM plans. Your plans and directions certainly are easy to follow.

Ship modeling is certainly a test of patience when you have to make every part by hand. Ready-made parts are not obtainable in this country.

Donald A. McBean.

A beautiful model, McBean. Congratulations!

***

Another letter which was awarded a $3 prize in this month's Workbench contest was received from John S. Phill, of Belfield, N.D., who wrote:

Dear Editor:

I am enclosing a photo of a built-

[*Turn to page* 31]

Donald McBean's model "Mayflower," built to MM plans.

Mike Liptak and his brother proudly hold the five-foot "gas" powered model airplane they constructed. The model flew out of sight during a contest, but was returned to the boys again.

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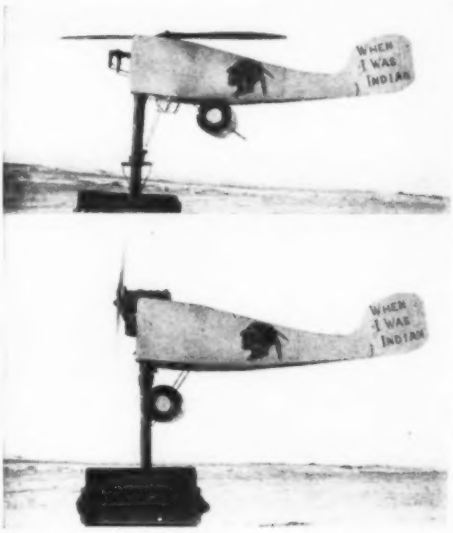
Editor's Workbench Chips

[*Continued from page 29*]



Resembling an airplane fuselage in appearance, this novel windcharger was built by John S. Phill, of Belfield, N. D. Top photo shows how moving the wheels retracts generator.

up wind generator device I constructed. Note the resemblance to an airplane.

When it is desired to stop the device, the wheels can be moved back, tilting the generator and propeller by means of cables. Unlike the Indian sketched on the charger, I am a "paleface" cowboy.

John S. Phill.

***

Reader Phill certainly selected a novel mounting for his wind generator. Any day now, we'll be expecting to see someone send in a photo of a wind generator like Phill's to which a wing has been added to heighten the illusion of a plane in flight.

***

Don't forget that MM awards cash prizes every month for the best photos and letters received describing completed projects made in home workshops. Take several clear photos of your latest project, write a short description of it, and send it along to the Workbench. Your entry will receive careful consideration and you may be one of the winners of next month's awards.

* * *

A list of addresses of manufacturers of items mentioned in MODERN MECHANIX will be sent to any reader upon receipt of a stamped, return envelope.

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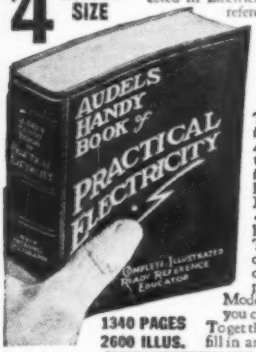

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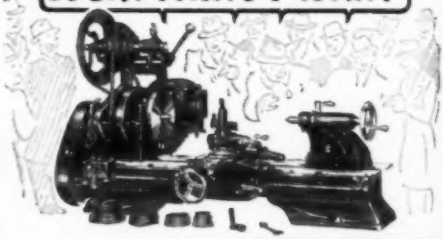

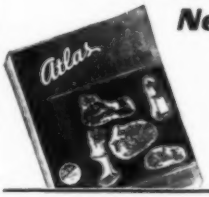

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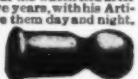

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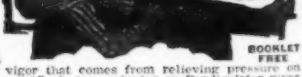

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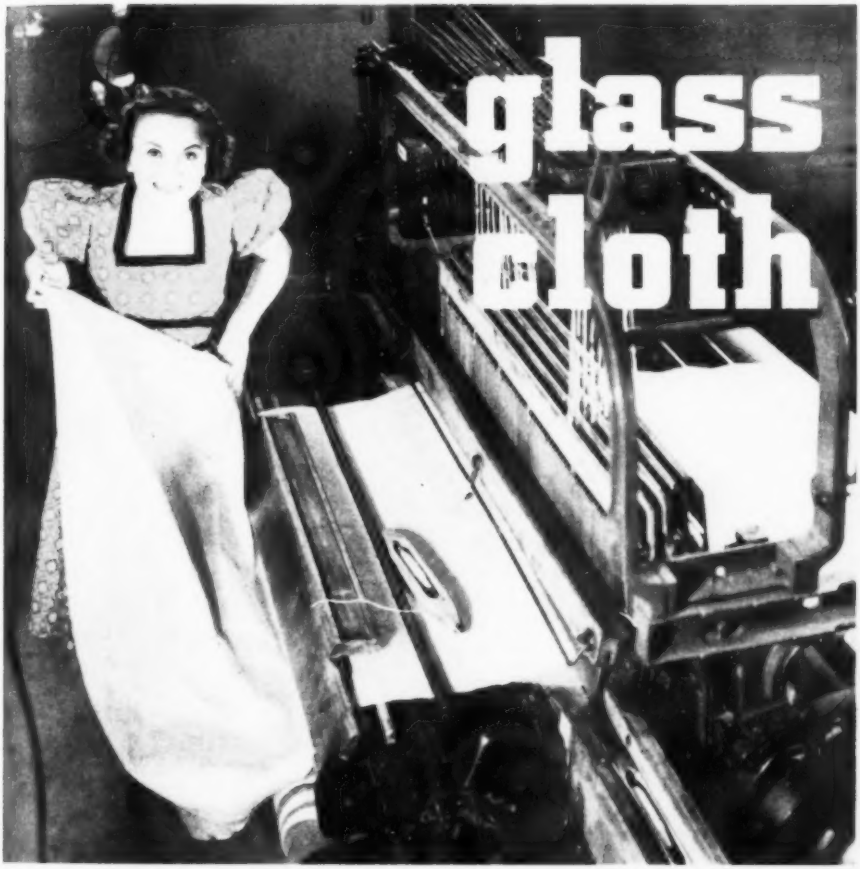
Volume XIX
Number 4

MODERN MECHANIX

FEBRUARY
1938

W. H. FAWCETT, Publisher



NEW MARVEL OF SCIENCE

GLASS is one of the hardest and most brittle substances known to man. Yet comparatively simple but highly ingenious machines transform it into a soft, lustrous and flexible material which is woven into actual "cloth" on ordinary looms, as pictured above.

Known as "Fiberglas," the new textile is not affected by temperatures as high as 700 degrees, is resistant to corrosive chemicals, does not absorb water, and is a highly effective electrical insulator. It promises to revolutionize old industries and create new ones as it goes into commercial, large-scale production for the manufacture of such things as cords, threads, ropes, tapes, webbings, filters, awnings, curtains, draperies, screens, wall coverings, table pads, doilies, pictures, etc. Although now available only in natural white, the glass cloth eventually will be offered in

Left: These thin mats, composed of thousands of strands of Fiberglas, are used as air filters for warm air furnaces, and industrial machines operating in dusty atmospheres. This is one of the many applications of "glass cloth."

Below: Fascinating to watch is this "staple process" of forming glass threads. The molten glass is blown down past the drying flame at the edge of the picture, and forms almost out of thin air as fine white threads, which are taken up on the spools.

a wide variety of permanent colors for every decorative purpose.

Fiberglas is made by two methods developed by the Owens-Illinois Glass Company at Newark, Ohio. One is known as the "continuous filament" process, the other as the "staple fiber" method. In both processes glass marbles about ¾-inch in diameter are fed into electrically-heated furnaces which have a trough or V-shaped bushing made of costly metals of a higher melting point than glass. The molten glass, entering the open end of the bushing, is "drawn" downward by the force of gravity in the continuous-process method, the glass emerging from 102 tiny holes in the bottom of the bushing. These fine filaments, almost too small to be seen with the naked eye unless light strikes them at critical angles, are combined to make one thread-like strand only .024 inch in diameter, for winding on spools. The latter are transferred to machines for fabrication into tapes and cloths. A single marble, weighing only ¼-ounce, produces the incredible amount of 90 MILES of glass fiber, so finely are the threads drawn.

In the staple-process, the molten marbles are forced downward through tiny holes in similar bushings, but instead of being "drawn," they are blown downward by blasts of steam under high pressure. Passing through a burst of flame which removes the moisture from them, the fibers gather upon and are drawn from a revolving drum, to be wound on revolving spools, which are taken to textile spinning machines for twisting and reduction to thread.

In the "continuous filament" process, 102 fine strands of glass, formed by tiny holes through which the molten glass passes, are formed into a single thread. They have been greatly retouched in this picture, actually they are hardly visible to the eye.

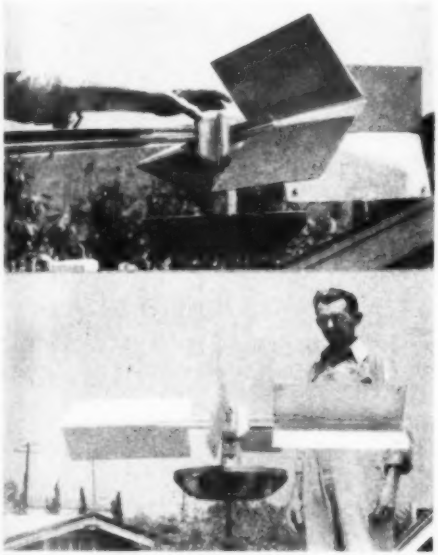
Foot-Powered Vehicle Travels On Water Or Land

PROPELLED by a foot-pedal mechanism, a hydro-cycle invented by M. Villeneuve, of Paris, France, is said to travel with equal facility on land or water. The novel vehicle consists of a boat-like body mounted on axles featuring small rubber tired wheels.

A foot-pedal mechanism placed before the driver's seat is geared to the rear set of wheels, providing locomotion on land. For use on the water, the front and rear wheels of the craft are removed and a set of small paddle wheels is attached to the rear axle.

Propelled by a foot-pedal gear mechanism, this hydro-cycle travels on water or land. When used on water the four wheels are removed, being replaced by paddle wheels on rear axle.

Wind Charger's Vanes Fold



Top—Presenting less air resistance than common windmill types, this novel wind-power generator features collapsible blades actuated by equalizing springs in center housing. Lower photo—The slightest breeze causes the blades to rotate.

A NEW tail-less wind power generator developed by H. H. Raulerson, of Long Beach, Calif., operates regardless of the position in which it is set or the direction from which the wind is blowing. The device features four collapsible two-piece vanes connected to a center housing. When the vanes rotate in the wind, one side catches the full power of the wind while the other is folded flat, the action being governed by equalizing springs and small gears located in the center housing. The slightest wind is said to actuate the device.

Croquet Game Modernized

MODERNIZED croquet sets consisting of hard sponge rubber balls and semi-hard rubber mallets are finding favor with game-loving Americans. Produced by a large rubber products manufacturer, the new equipment is claimed to have speeded up the game, requiring skillful play on the part of the participants and creating a new respect and interest which may return the pastime to its former popularity. The rubber equipment shows very little wear after unusually hard usage, according to players.

Speeding up the game and requiring more skillful playing, rubber balls and mallets have modernized the game of croquet.

FLYING THE SUB

by
Donald G. Cooley

Left—New York's mayor, Fiorello La Guardia, in the control cab of the train that opened the new link of the Independent Subway connecting Queens and downtown Brooklyn. Top—A quick-accelerating, short-stopping train of the Independent Subway pulls into the Hoyt Street station. Subway stations are brightly illuminated and well maintained.

YOU shoot through a winding tunnel streaked with colored lights, dive under a river, zoom up on the other side, fly past crowded platforms, sway dizzily as you dash around a curve at breakneck speed—it's a crashing, flashing, thrilling scene that thunders past as you ride the subway express!

Sightseers in New York soon discover the subway to be one of the city's miracles. For five cents they can ride for hours or for days on the world's most exciting underground railroad. When the American Legion held its big 1937 convention in New York, hundreds of Legionnaires stated that the big thrill of their outing came when they stood in the first car of a speeding subway train and found adventure around every curve.

Cave-dweller that he once was, man finds the subway an irresistible lure. There is mystery in every inch of it, the mystery of

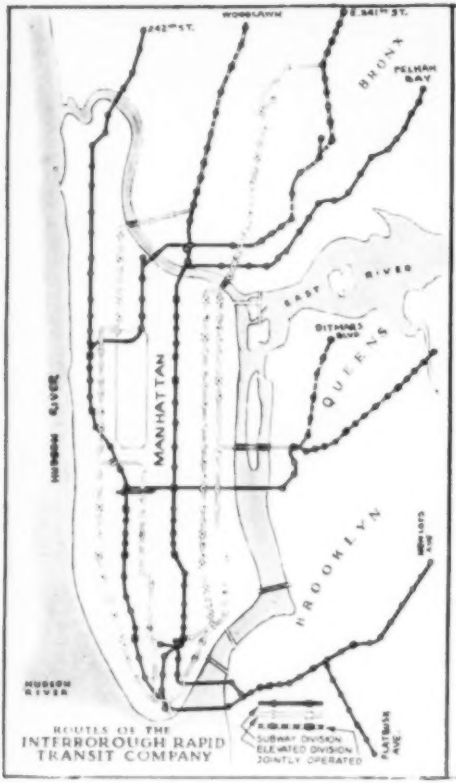
WAY EXPRESS

Top—A typical station scene during rush hours. Carrying about 1,000 passengers each, as many as 32 trains enter and leave a station each hour during the rush periods. Right—A subway motorman at his controls. No current can be applied to the motors until the doors in every car of a train have been safely closed. (I. R. T. photo).

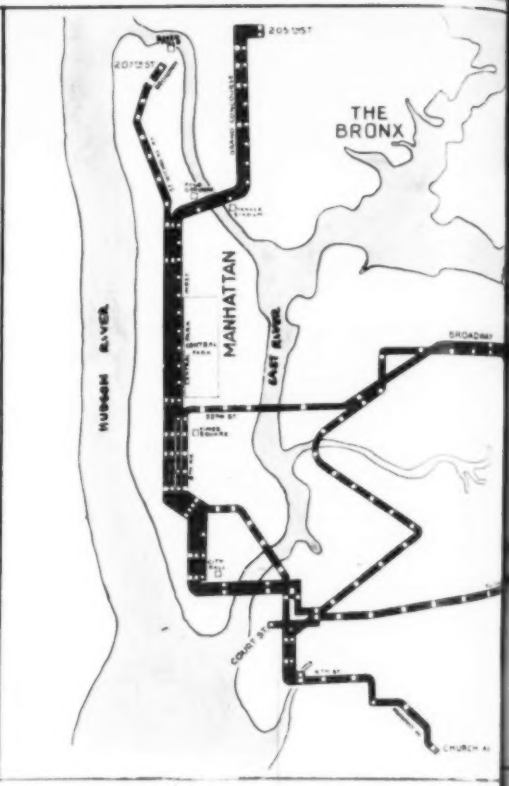
Mother Earth who yielded grudgingly to human burrowers. That block which you just flashed past in hurtling seconds—above it rises a $50,000,000 skyscraper. That pressure in your ears which warns that you are diving down—over your head flows a mighty river carrying tugs and ocean liners.

Actually, New York does not have a subway, but *subways*. There are three systems, the I. R. T. (Interborough Rapid Transit), the B. M. T. (Brooklyn Manhattan), and the Independent, the latter municipally owned. Their routes cover more than 200 miles and on a single day they carry some 4,000,000 passengers. This is equivalent to transporting every person in a city larger than Chicago every day. To achieve this major miracle more than 5,000 cars which travel at speeds up to 48 m.p.h. are required.

Since Manhattan itself is only 13 miles



Shown above is a map of the New York and suburban routes of the Interborough Rapid Transit Company, one of the city's three subway systems.



Owned and operated by the city, the Independent Subway, the routes of which are shown above, is New York's newest and fastest underground railway, reaching far into Queens.

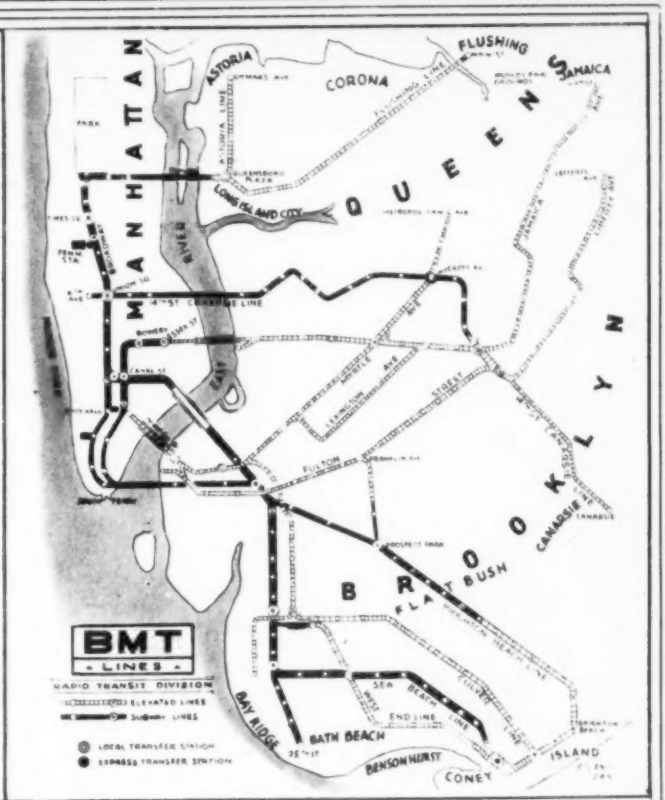
long, much of the subways' trackage reaches out to suburban regions. The subway runs under the East River to Brooklyn, under the Harlem to the Bronx, through the Queensboro tubes to Queens. In the Bronx, Brooklyn and Queens, it comes out from underground and becomes an elevated.

The place to savor the thrill of a subway ride to the utmost is in the very front of the first car of the train. An open doorway with guard-chains hung across it is all that stands between you and the stretch of gleaming track that runs off mysteriously into the dim distance. The motorman's compartment lies behind a steel door which shuts him off from the rest of the car. The space is just about large enough to accommodate one man, but since this is a special sightseeing tour we will edge in with him.

The train is halted in the station, the doors are open, and the control handle is moved to its

The Subway Comes Up For Air

In the Bronx, Brooklyn and Queens areas served by New York's three subway systems, much of the trackage runs outdoors on elevated rights-of-ways. (N. Y. C. photo).



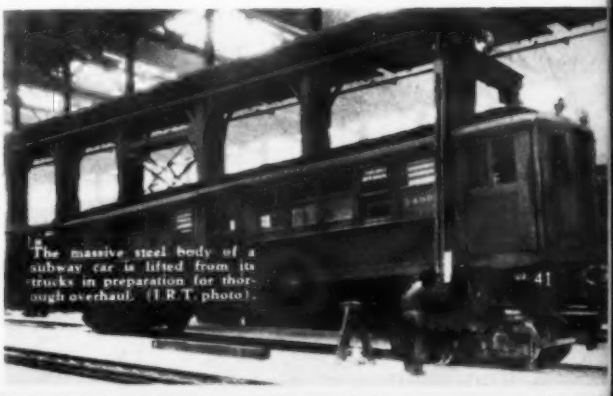
The majority of the Brooklyn-Manhattan Transit subway routes extend into the boroughs of Brooklyn and Queens, as shown on the map above.

first notch. The controller is very much like that used on electric street railways. The instant the last door closes, the train starts to move—a precious split-second has been gained by that little trick of leaving the control handle "on." Two electric bulbs on the controller in front of the motorman light up to give him the "all clear" signal for starting, but they are really unnecessary. While the car doors are open, no current can pass through the motors; the very second they close (unless the controller is "off") voltage hurtles into action and almost by the time the last car has cleared the platform, the train is notched up to full speed to maintain schedule.

Speed! More speed! Speed with safety! Speed is the driving genie of the subway, not alone speed on the straightaway, but speed on the getaway. Ahead of us, around

[*Continued on page* 132]

"Time Out" For Periodic Inspections



The massive steel body of a subway car is lifted from its trucks in preparation for thorough overhaul. (I.R.T. photo).

SCIENCE BATTLES

Almost totally obscured by fog, the disabled schooner *Uvira* is towed into port by the U. S. Coast Guard cutter *Pontchartrain*. Note the lengthy towline slung between the two vessels.

THE maritime nations of the world are spending millions to obtain speed at sea. The *Queen Mary*, the *Normandie*, the *Rex*, and hundreds of lesser liners plow fearlessly through the oceans at express-train speeds, working on schedules almost as iron-clad as those of railroads. Mountainous green seas, breaking in white foam over the bows, might terrify the landsman, but they are of little concern to the mariner, for they menace neither the safety nor the speed of the ship.

It is minute droplets of water, so tiny that they hang suspended in air, that endanger life at sea—that cost ship owners millions in wages, fuel and lost revenue. Twenty thousand collisions in fog during the past ten years have taken toll of 23,000 lives. Fog is still the big menace to navigation—still remains the challenge to science.

A few years ago, while on recruiting duty with the Marines, I tried to get a mother's consent to the enlistment of her minor son. She wired that she consented, providing that he would not be sent more than ten miles to sea. She did not understand that the high seas are comparatively safe—that it is close to shore, especially at the focal points of traffic.

Unaffected by magnetic variations, the gyro compass (above) is used in conjunction with a polarus to obtain accurate visual bearings near shore.

s Fog Menace

Mechanical devices minimize the clammy mists' death toll.

by Bob Gordon

In the photo at left, a lighthouse tender crew is shown placing a tank of acetylene gas fuel in a lamp-equipped channel buoy. Above—A victim of fog, the *Welboro* grounded on the rocks off Fisher's Island lighthouse in Long Island Sound.

Left—The 10,000-ton liner *Iroquois* with her bow high out of the water after grounding on the Maine coast during a heavy fog in July, 1936. The 112 passengers were safely removed, after which the liner was successfully refloated.

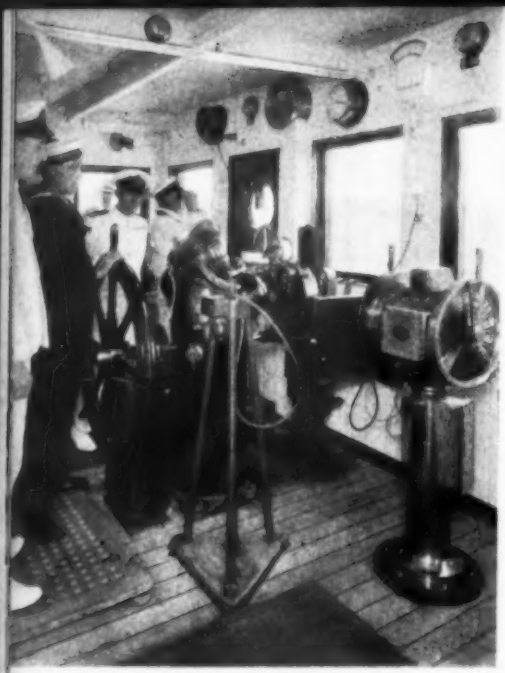
near port or in the harbor, that the real danger lurks. The most vital concern of a navigator is to determine his position when approaching the coast—to keep his ship in deep water and out of the path of other vessels navigating in darkness or fog.

For this last ticklish stage of an ocean journey, the U. S. Lighthouse Service maintains 25,000 aids to navigation along our coasts and inland waterways. There are 2,000 such aids in the vicinity of New York alone, 600 of which are within the harbor. These aids consists of lighthouses, lightships, buoys and radiobeacons.

The U. S. Navy also maintains several radio stations at strategic points along the coast. Upon request these stations will take radio compass bearings and transmit them to the ship. With bearings from two or more such stations plotted on the chart, the ship's position is readily determined. The ship requires no equipment other than its regular radio to receive such bearings.

The radio, however, is not absolute. With only two bearings the lines will meet at a single point. A third bearing will seldom

ST. LOUIS PERIODICAL HOUSE



The bridge of a modern ocean liner (above) is equipped with every known device that will help her officers navigate through fog. Right—Lightship No. 12, guardian of the treacherous Nantucket Shoals. Her sister ship was cut in two when rammed by the liner *Olympic* during a heavy fog, seven of the eleven-man crew perishing.

cross this point, but may form a triangle several miles on each side. The captain will only know his ship is somewhere within this triangle.

This failure to obtain an absolute fix by radio is due in part to the fallibility of the human ear, for which no satisfactory substitute has yet been found. The man taking these bearings swings a loop antenna over a compass card until the sound of the signal dies out completely. Noting that azimuth, he swings his loop in the other direction until he gets another null. The bearing he receives will be the difference between the two determined fading points.

This method is found to be more accurate than attempting to determine the point of the signal's greatest intensity, but it still permits an error. If this error is only one degree, it will mean an error of four miles to a ship 300 miles at sea. Errors of from five to ten degrees are not uncommon.

Having thus determined his approximate off-shore position while several hundred miles at sea, the navigator making a landfall in a fog will then tune in on the various lightships and lighthouses having radiobeacon equipment, from which he may obtain continuous bearings, or fix his position by cross bearings in a manner quite similar to that previously described.

Getting a radiobeacon bearing is just the reverse of obtaining bearings from the Naval stations, in that the radiobeacons broadcast assigned dot and dash signals, which are automatically repeated over and over again. These signals are picked up by the ship's radio direction finder—a separate receiving set on the bridge, having a loop antenna with an indicator mounted over a magnetic compass or gyro-compass repeater. Here again the receiver, this time the navigator, obtains a null on both sides of the signal, and takes as his bearing the azimuth between the two determined fading points.

Such bearings are subject to the same errors as those received from shore stations; but, like the dial phone, which allows us to pick our own wrong numbers, the navigator has the consolation of knowing that any errors made are his own. Each radiobeacon sends signals for sixty seconds and remains silent for two minutes, during two ten-minute periods of each hour, except in fog, when it broadcasts continuously.

It is the usual practice for ships approaching New York from Europe to steer directly on Nantucket Lightship during a fog. In the spring of 1934 the S. S. *Washington* followed the beacon so closely that it brushed against the lightship, carrying away some of its upper rigging. A short time later the liner *Olympic*

loomed out of a heavy fog to cut the 133-foot *Nantucket* squarely in two. Seven men, of a crew of eleven, perished.

Since that disaster the Lighthouse Service has developed a low-power warning transmitter, broadcasting on the same time and frequency as the radiobeacon, that gives out a distinctive warble note. When this note is heard, the navigator knows it is no longer safe to steer directly on the beacon.

The Lighthouse Service has completed installation of equipment on most of its lightships that synchronizes the compressed air fog horn with the radiobeacon signal by means of an electric timer. The radiobeacon has a silent period of a few seconds near the end of every third minute. There is then a one-second warning note on both the radiobeacon and the fog horn, a one-second

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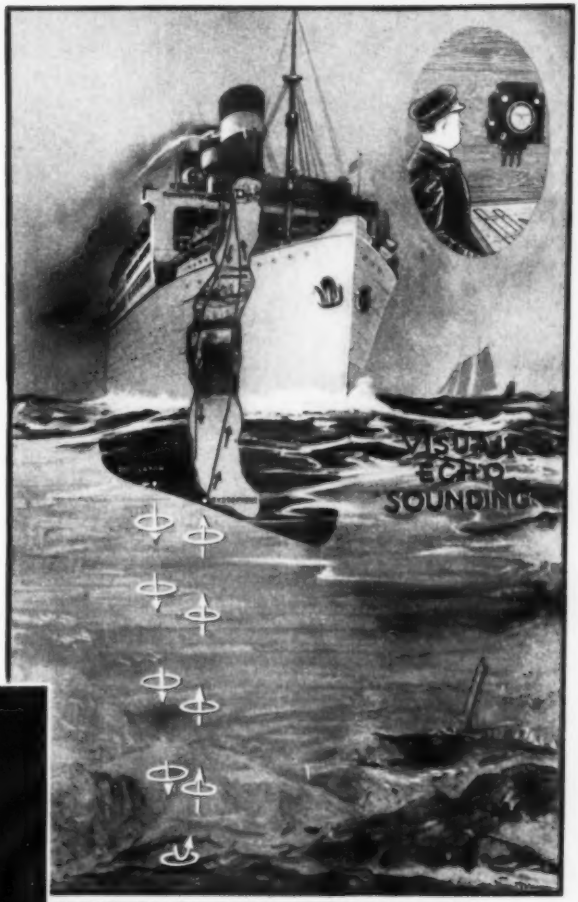
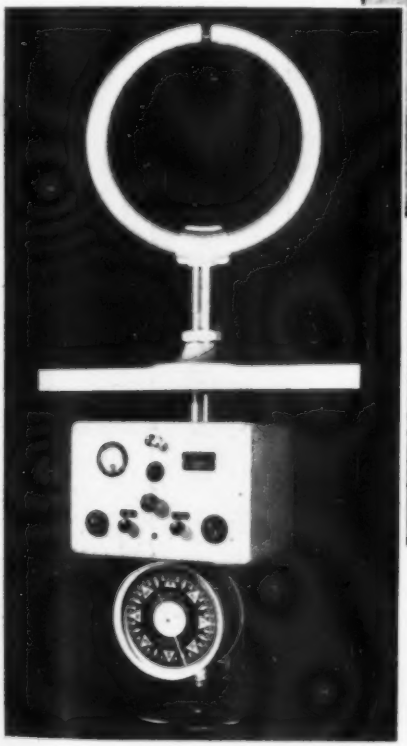
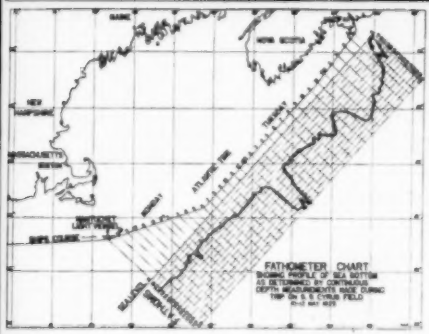






Radio direction finders (left) help mariners determine a ship's position when sky and sea are obscured by fog. Top—By taking soundings with a fathometer, as shown in top sketch, a navigator can check depth of water under his ship's keel to avoid reefs. Shown above is a chart of ocean depths from Nantucket Lightship to Halifax, as recorded by a fathometer aboard *S. S. Cyrus Field*.

Builds Odd Sternwheel Boat

Using a washing machine motor, two fan pulleys from a refrigerator, spokes from an old chair and other salvaged materials, Louis Goodman of Detroit, Mich., built this sternwheel boat.

POWERED by a one-cylinder gasoline engine salvaged from a washing machine, a novel sternwheel boat constructed by Louis Goodman, of Detroit, Mich., carries three persons at a speed of five miles per hour. The craft is steered by moving the sternwheel and motor unit by means of a handle that projects from beneath the motor frame. The sternwheel can also be raised or lowered, permitting use of the boat in shallow water.

Goodman constructed the sternwheel, which has a diameter of three feet, from odd pieces of equipment such as two fan wheel pulleys from an old refrigerator, spokes from an old porch deck chair, and six flat pieces of board. A curved and adjustable galvanized sheeting shield serves to protect occupants of the boat from the spray caused by the churning of the sternwheel.

Chemical Ends Dye Bleeding

YOU might shudder at the odor of a stale egg, or turn up your nose at the smell of a bad fish, or choke on ammonia fumes, but the ammonia which chokes, the hydrogen sulfide gas which makes the egg smell bad, and the phosphine gas which makes the fish smell foul, are the basis of the newest test tube "babies" for the textile industry—the "onium" compounds.

Watch particularly the quaternary ammonium, phosphonium, and sulphonium chemical infants. These are complex compounds with hearts of nitrogen, phosphorus and sulphur atoms. They bring joy to the textile dyer, printer and finisher, who is responsible for the beautiful color and finish of the clothes you wear.

Does the dye in a dress "bleed;" that is, run when it is wet or contacts perspiration? Just dip it in a warm solution of cetyl pyridinium bromide, rinse and dry. Notice how fast the dyes become. Water and perspiration no more make them run.

Did the dyer put the wrong dye on the fabric, or didn't the dye go on evenly? He needn't worry. He can strip the dye completely from the fabric and dye all over again. Trimethyl cetyl ammonium bromide, another one of those new "onium" compounds does the trick.

Other of the "onium" chemicals whose names need not worry the layman have now made it possible for the dyer to use wool dyes on cotton and synthetic silks. This is helpful for the wool dyes have always been of brighter shades than the others.

Device Exposes Drunkards

Professor R. N. Harger shows a Missouri trooper his new device for checking amount of alcohol in autoist's breath.

A "DRUNKOMETER" device, designed to determine the amount of alcohol present in the breath of persons arrested for driving while under the influence of liquor, was recently demonstrated at a National Safety Congress held in Kansas City, Mo. The test

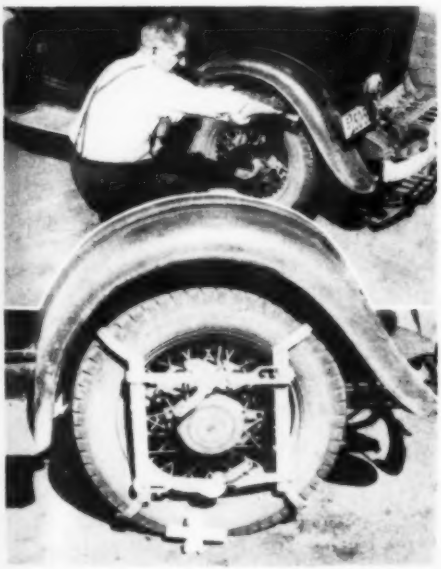
apparatus was invented by Professor R. N. Harger, chemistry professor at the Indiana University School of Medicine.

To operate the "Drunkometer," the suspect blows his breath into a rubber balloon to which is fitted a tube leading into the machine proper. The balloon is then emptied, the air passing through tubes containing special chemicals which register the amount of alcohol fumes present by changing in color and clearness.

New Tire Irons Aid Mired Cars

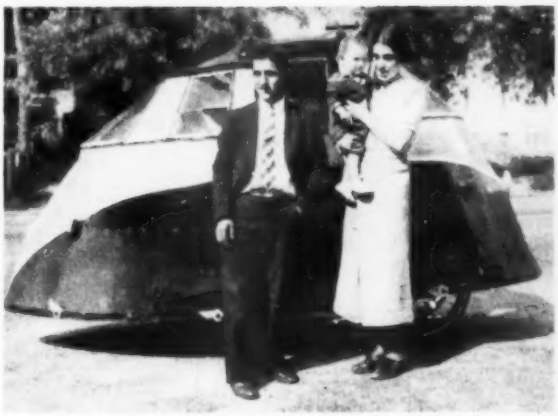
CONSISTING of two pairs of steel bars fastened at each end with U-shaped irons, a device invented by Louis Karon, of Superior, Wis., is said to provide an improved means of enabling an auto to pull itself clear of a muddy ditch or snow bank.

The new device can be attached to an auto wheel in a few minutes time without lifting the car from the ground. If necessary, it can be installed directly over regular type anti-skid chains. Additional extensions to the bars give even greater traction in soft snow.



The U-shaped steel bars of a new auto tire device (bottom) are said to enable a car to free itself from a mud ditch or snow bank. Device is installed without jacking car (top).

Family Of Three Travels In Home-Built "Cyclemobile"



The A. Martin family of Dracutt, Mass., uses this "Cyclemobile" for trips to nearby towns. Vehicle consists of two bicycles joined together and covered with a canvas hood.

TWO bicycles joined together by means of a specially constructed frame and covered by a streamlined, water-proofed canvas hood, serve as a novel and cheap medium of transportation for A. Martin, of Dracutt, Mass. Dry batteries supply current to operate the front and rear lights of the "cyclemobile," as the odd vehicle has been named.

Resembling an automobile of radical design in its appearance, the cyclemobile's hood boasts ising-glass windows. The interior is fitted with luggage compartments and a berth for Martin's 18-month-old daughter. Husband and wife work dual sets of pedals.

Machine Jots Code On Tape

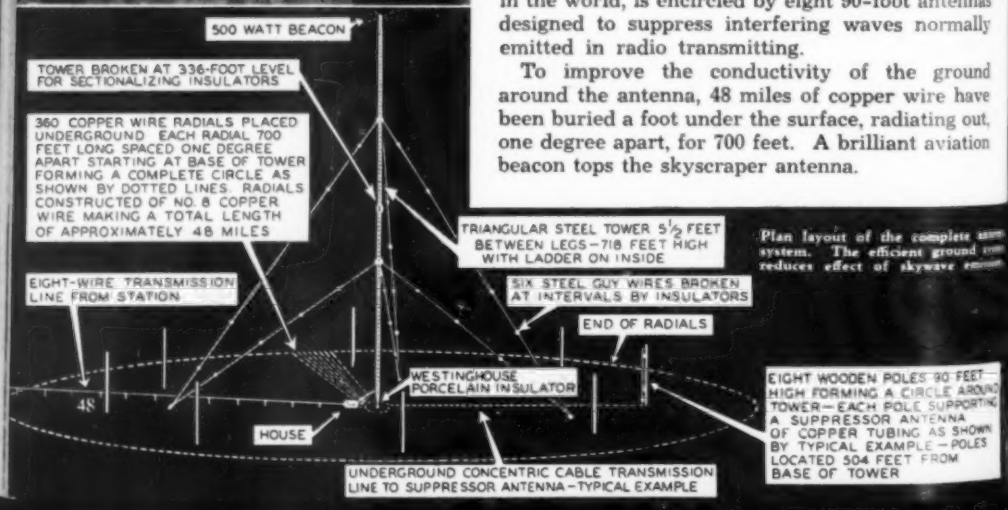
DESIGNED for attachment to any radio receiver, the code reader device illustrated here transforms code signals into a visual record of dots and dashes on a special chemically treated tape. The machine will operate at speeds up to 300 words per minute.

New Giant ANTENNA For KDKA

KDKA's new 718-foot antenna is composed of 32 three-cornered welded steel sections placed one atop another (above). The 60-ton structure rests in a ball-and-socket joint of a huge porcelain insulator, as shown at left.

TOWERING 718 feet high, a new vertical antenna erected for radio station KDKA in East Pittsburgh, Pa., will enable primary broadcasting service to be given over an area ten times greater than that previously provided. The mammoth antenna, claimed to be the highest welded structure in the world, is encircled by eight 90-foot antennas designed to suppress interfering waves normally emitted in radio transmitting.

To improve the conductivity of the ground around the antenna, 48 miles of copper wire have been buried a foot under the surface, radiating out, one degree apart, for 700 feet. A brilliant aviation beacon tops the skyscraper antenna.


500 WATT BEACON
TOWER BROKEN AT 336-FOOT LEVEL FOR SECTIONALIZING INSULATORS
360 COPPER WIRE RADIALS PLACED UNDERGROUND EACH RADIAL 700 FEET LONG SPACED ONE DEGREE APART STARTING AT BASE OF TOWER FORMING A COMPLETE CIRCLE AS SHOWN BY DOTTED LINES. RADIALS CONSTRUCTED OF NO. 8 COPPER WIRE MAKING A TOTAL LENGTH OF APPROXIMATELY 48 MILES
TRIANGULAR STEEL TOWER 5½ FEET BETWEEN LEGS—718 FEET HIGH WITH LADDER ON INSIDE
EIGHT-WIRE TRANSMISSION LINE FROM STATION
SIX STEEL GUY WIRES BROKEN AT INTERVALS BY INSULATORS
END OF RADIALS
WESTINGHOUSE PORCELAIN INSULATOR
48
HOUSE
EIGHT WOODEN POLES 90 FEET HIGH FORMING A CIRCLE AROUND TOWER—EACH POLE SUPPORTING A SUPPRESSOR ANTENNA OF COPPER TUBING AS SHOWN BY TYPICAL EXAMPLE—POLES LOCATED 504 FEET FROM BASE OF TOWER
UNDERGROUND CONCENTRIC CABLE TRANSMISSION LINE TO SUPPRESSOR ANTENNA—TYPICAL EXAMPLE

Plan layout of the complete ... system. The efficient ground ... reduces effect of skywave ...

Street Alarm Box Calls Either Police Or Firemen

AN EMERGENCY alarm system developed by Berkley E. Cover, of Chicago, Ill., enables a call to be made for policemen or firemen, according to the emergency, from the same signal box. The sender of the alarm can talk into a microphone at the street signal box or, if too excited to talk, can send the alarm by turning dials marked "Fire" and "Police."

The street signal boxes in the new alarm system are connected

A new street alarm box (left) enables fire or police alarms to be sent verbally over a phone or by turning proper dial. Central switchboard operator (above) receives call and sounds alarm in fire or police station that is nearest the street box from which the original call was sent.

to the switchboard of a central office. Upon receiving an alarm, the dispatcher at the central office speaks into a microphone connected to loudspeakers in every fire station in the city. In less than one minute, the fire-fighting apparatus nearest the blaze is on its way. The same procedure is followed in contacting police stations in order to send a patrolman, squad car, or emergency crew wherever needed, enabling authorities to gain control of situation in minimum time.

Camera On Policeman's Revolver Snaps Evidence

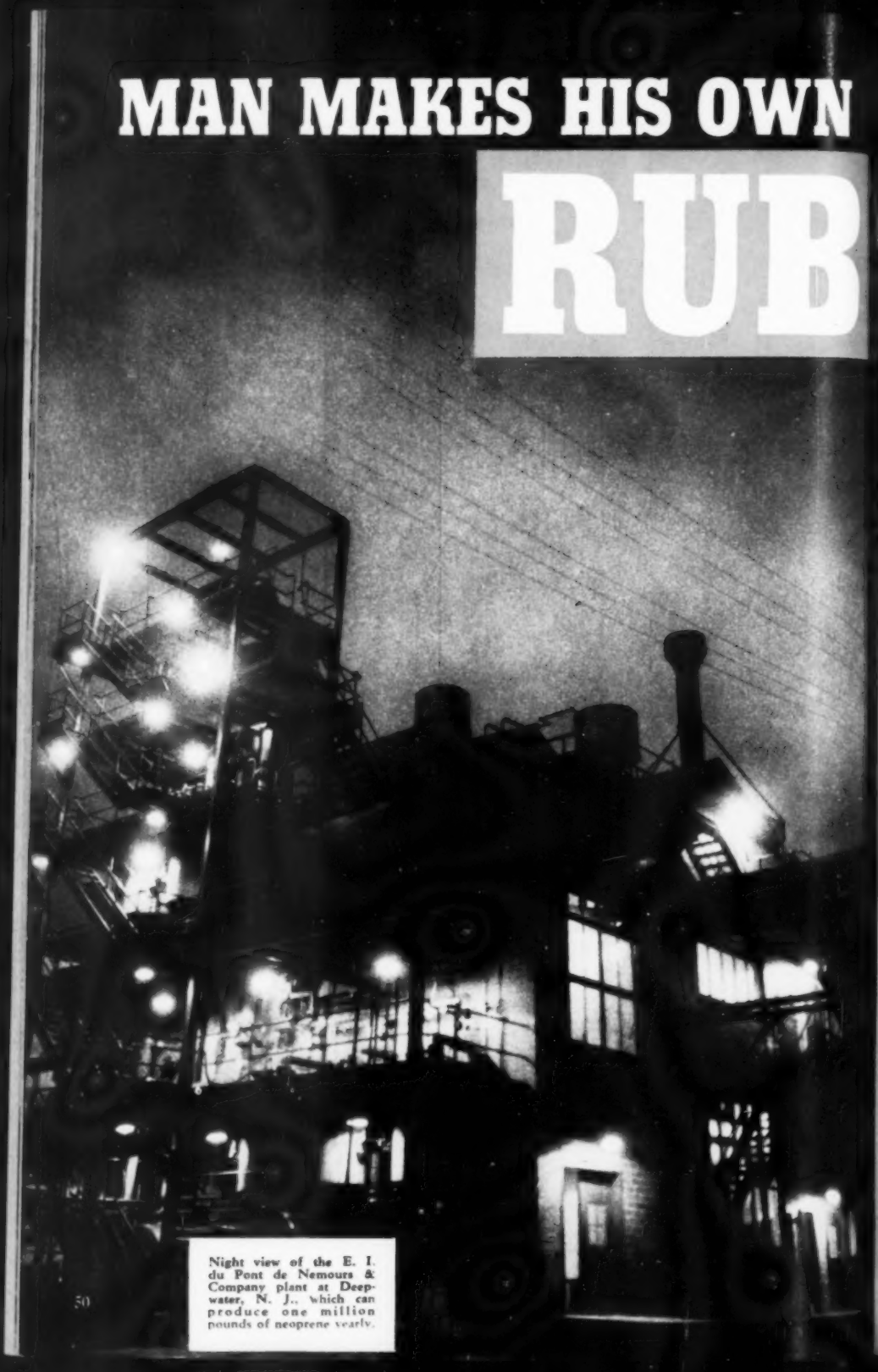
ATTACHED to the barrel of a service revolver, a compact motion picture camera enables a policeman to take action pictures of any person at whom the revolver is aimed. The pictures thus obtained can be presented as evidence at court.

The motion picture camera is triangular in shape and is attached under the barrel of the revolver by means of metal clamps. The lens is directly in line with, and under, the revolver muzzle. The camera is set in action by a slight pressure on the revolver trigger, independent of the firing of the weapon. Due to the compact size of the gun camera device, only a small roll of film can be accommodated at one loading.

If you are interested in items described in this issue, send a stamped, return envelope for a list of manufacturers' addresses.

Attached to the barrel of a revolver, a new compact motion picture camera helps policemen secure evidence of crime.

MAN MAKES HIS OWN RUB



Night view of the E. I. du Pont de Nemours & Company plant at Deepwater, N. J., which can produce one million pounds of neoprene yearly.

BER

THE diversified chemical manufacturing industry of America is finding a way to make this country free from dependence on foreign sources for an increasing number of vital raw materials. Only a few years ago, America depended on the nitrate beds of Chile for fertilizers and raw materials for industry. Today, it makes its own nitrates from the air.

Camphor was from time immemorial a natural monopoly of the Far East. Today, America makes its own synthetic camphor for medicine and the needs of industry. A large and increasing number of medicinal and other compounds, formerly imported, are now being produced here. And now rubber may be added to this list of essential raw materials.

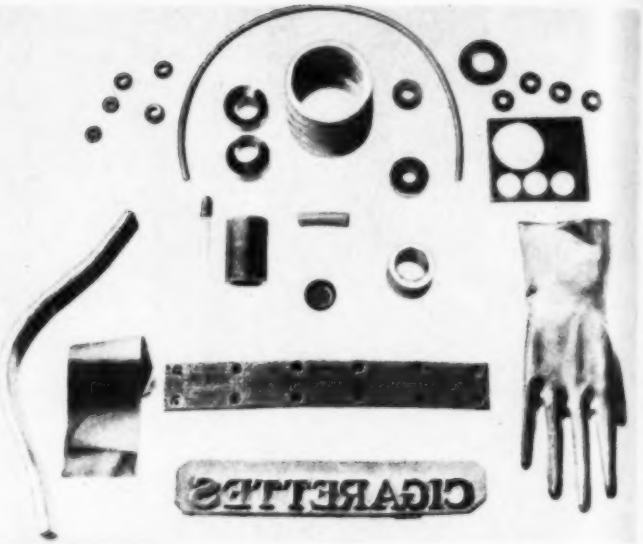
Neoprene resembles natural rubber more closely than any other artificial product. An X-ray discloses that its physical structure is the same even though its chemical composition is different. Photo shows one of numerous steps required in processing neoprene.

Plasticizing and drying neoprene. Apparatus unlike anything the chemical industry ever before knew made it possible for chemists to produce a rubber substitute that excells Nature's product in its adaptability.

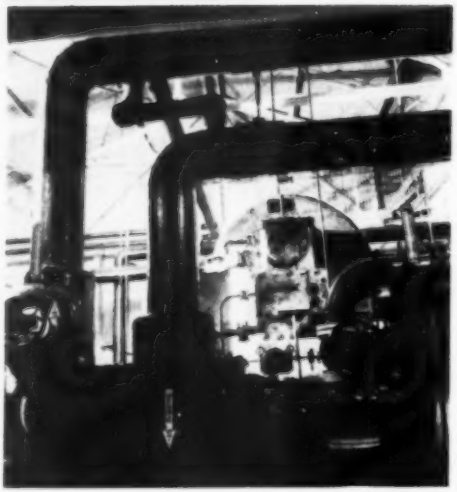
Rubber is a vital element in our life. It is used not only for tires but for thousands of other products that are essential to our industrial civilization. More than ninety-nine per cent of the world's rubber is grown in the tropics. Many attempts have been made to grow substitutes for rubber in the United States, but none has ever succeeded.

Millions of American dollars, British pounds, and German marks have been expended during the past fifty years in an attempt to produce a synthetic rubber; that is, a product identical with natural rubber made by chemical means, preferably from raw materials that are freely available in these industrial countries. All of these efforts to produce a true synthetic rubber have met with failure. Germany, during the World War, did produce a synthetic product that was used as a substitute for rubber, but it was a very poor imitation of the natural product and consequently its production was dropped as soon as the war ended in 1918.

Finished articles made of neoprene (right) not only look like those made of crude rubber and have the same elasticity and toughness, but also have the added ability to resist the action of oils, gasolines and solvents which destroy real rubber. Because of these advantages neoprene's use increases daily.



Some of the massive equipment used to carry out the chain of chemical miracles involved in the production of neoprene is shown below. The process consists of an intermarriage of certain gases to produce liquid chloroprene, which in turn is converted into the tough, rubber-like solid known as neoprene.



In 1925, research chemists of the du Pont Company began to work on the rubber problem, but they did not try to duplicate natural rubber as others had done. "Why," they said, "should we assume that the product created by nature for an entirely different purpose is the best material for making the thousands of rubber products that modern industry requires? Why be content to reproduce in the laboratory the product that Nature has provided? Let's start with different raw materials and produce a product that is even better adapted to present-day industrial requirements." Among other things, they visualized a process for the production of a rubber-like material from acetylene gas. The first experiments were quite disappointing, but help came from an unexpected quarter.

The chemical director of the du Pont Company attended the first symposium on organic chemistry which was held in Rochester by the American Chemical Society. At that meeting, Father J. A. Nieuwland of the University of Notre Dame told of the results of some of his experiments on the chemistry of acetylene. Father Nieuwland had been studying the gas and conducting research into its properties for many years and was recognized as the outstanding authority on its behavior from a scientific point of view.

His report told how he had succeeded in causing acetylene to polymerize, or, in plain words, to form giant molecules by combination of smaller molecules with one another. Acetylene when combined in this way became a different chemical entirely called di-vinyl-acetylene. That was something that the du Pont chemists had not tried. Arrangements were made to have Father Nieuwland's experiments duplicated in the du Pont laboratories and an effort was made to convert this di-vinyl-acetylene to synthetic rubber, but it did not work. From di-vinyl-acetylene the chemists were able to obtain only the hard, brittle resins that Father Nieuwland had already produced.

The next step in the pursuit of a better rubber substitute was taken by a group of chemists who found that by changing the

[*Continued on page* 118]

Belt Drive Replaces Wheels On Novel Motorcycle

Equipped with a drive belt instead of wheels, this "tractor-cycle" is said to traverse steep hills and rough roads with ease. A military adaptation of the novel cycle is shown on the MM cover miniature reproduced at the left.

DEVELOPED primarily for operation over rough ground, a new type of motorcycle invented by J. Lehaitre, of Paris, France, features a tractor-type drive belt as its means of locomotion in place of conventional wheels. Named the "tractor-cycle" by the inventor, the novel vehicle is said to be superior to an ordinary motorcycle in its ability to climb steep and rough grades, although its speed on level ground is limited to about 25 m.p.h. Steering is accomplished by handlebars which control a sideways motion of the drive belt.

The tractor-cycle could easily be adapted for military use, as depicted on the cover of this issue by a MODERN MECHANIX artist. Fitted with a machine gun, the cycle could be used by dispatch riders or entire military units to travel over shell-torn terrain.

Power-Driven Timber Saw Has Stationary Blade

A POWER-DRIVEN saw used to cut timber during the construction of a huge wood crib at Grand Coulee Dam in Oregon features a blade that actually stands still while the cutting process takes place. The "secret" of the novel saw is that the teeth run on an endless chain around the blade, which merely serves as a guide for the teeth as they cut into the timber. A three-horsepower compressed air motor drives the chain. The saw is so designed that it can also be used under water without impairing its efficiency.

These workers are using a novel saw featuring a blade that stands still! The cutting teeth run around the blade on an endless chain, which is powered by a compressed air motor.

Addresses of manufacturers of products mentioned in MODERN MECHANIX can be obtained by sending a stamped, self-addressed envelope to the editors.

Scale Model Demonstrates Novel Racing Vessel

A scale model enables Otto von Kories to explain how hollow steel drums will propel a new vessel in which he hopes to travel over the water at a speed of more than 180 m.p.h.

A SCALE model of a streamlined vessel in which he hopes to attain a speed of 180 m.p.h. has been constructed by Otto von Kories, of Los Angeles, Calif. The model features all the equipment that will be found on the full-sized vessel when it is built, according to the inventor.

As shown by the model, Kories' design relates to a non-sinkable craft which will have a draft of only six inches, traveling over the water on hollow steel drums that act as paddle wheels. Driving motors will be located upon stationary carriages within each drum, being connected by gears to the circumferences of the drums. Three-foot circular openings in the ends of the drums will permit entry to the interior in the event that motor trouble develops. Control will be maintained from a bridge at the forward end of the novel craft.

Foot Pedal Controls Mainsheet Of Ice Yacht

STEERED by a wheel instead of a tiller, an ice boat produced by a leading manufacturer features a special clamping device that enables the skipper to hold the mainsheet by means of foot pressure on a pedal. The device automatically releases the sheet as soon as the foot is lifted off the pedal.

The bottom of the new ice boat is rounded, the runner plank being set flush with the bottom so as to reduce wind resistance. The craft is 18 feet long and features a 13-foot runner plank for single-seater types and an 11-foot runner plank for two-seaters.

A hollow mast of clear airplane spruce, which is secured in such a way that it will rotate freely and set itself automatically at any angle to the boat which continues the curvature of the sail, is also featured.

Designed for Class E racing, this ice boat features many improvements. Close-up shows pivot joint of free-rotation mast.

Navy Acquires Giant Patrol-Bomber Flying Boat

Four engines of 1,050 horsepower each are required to power this huge Sikorsky flying boat. Plane has three gun turrets.

CLAIMED to equal any known plane in military load-carrying capacity, a new patrol-bombing flying boat has been constructed for the U. S. Navy by the Sikorsky Aircraft Company, of Bridgeport, Conn. The huge aircraft is powered by four Wasp engines of 1,050 horsepower each and is equipped with the latest type three-bladed constant speed propellers.

Designated as XPBS-1, the bomber is an all-metal, high-wing, full cantilever monoplane of new design. Every known approved device for safety and ease of operation is incorporated in the construction of the craft. While strictly a flying boat, provisions are made for the carrying of beaching gear, such as is shown in the above photo, to facilitate beaching, docking or ramping when desired.

The new flying boat features an innovation in equipment—a 110-volt electrical system which generates power for all electrical units such as flaps, anchor winch, radio, lighting system, bomb controls, etc. An auxiliary gasoline engine drives the generator supplying the electricity. Complete radio equipment, comparable to that used on a destroyer, is installed in the Sikorsky bomber.

The armament of the XPBS-1 consists of bow, rear, and center gun turrets incorporating many new features in design. Being soundproof throughout and equipped with commodious living accommodations for the crew—a mechanics' workshop, galley with electric stove, water distiller and dry-ice refrigerator—sustained military operations are possible without affecting the physical endurance of the crew. No performance data has been released as yet.

Machine Analyzes Coloring

A RECORDING photoelectric spectrophotometer, an instrument which automatically determines the light reflection properties of any object by means of a complex photoelectric system, has been developed by a leading ink manufacturing firm. Applicable to all types of color analysis work, the machine can also be used in determining chemical compositions.

In operation, the color sample to be tested on the machine is placed at the end of a long tube. Its characteristics, transmitted by a photoelectric system, are then translated into a prosaic curve traced on a recording drum.

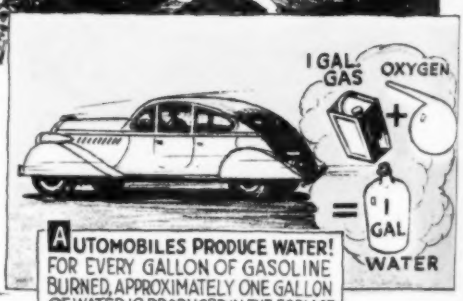
This photoelectric device enables operator to analyze color.

NIC SPRANK OFFERS $5.00 FOR BEST ODDITY

Army Plane Mounted 30 Guns

FLYING FORTRESSES ARE NOT NEW!— ALTHOUGH THE U.S. ARMY'S NEW FLYING FORTRESSES WITH 8 MACHINE GUNS ARE CONSIDERED THE LAST WORD IN DEFENSIVE AIRCRAFT, IN 1921 THE ARMY HAD A PLANE MOUNTING THIRTY MACHINE GUNS AND WAS PROTECTED BY 1-8 INCH ARMORED STEEL.—*Carl Jacoby, Brooklyn, N.Y.*

EARTH SUPPLYS FISHERMEN WITH PAINT!—NEAR LUBEC ME., MATERIAL FOUND IN THE GROUND, WHEN MIXED WITH FISH OIL, FURNISHES PAINT WHICH HAS BEEN USED BY FISHERMEN FOR NEARLY A CENTURY, TO PAINT THEIR BOATS.
Gerald Marshall, Auburn, Me.



AUTOMOBILES PRODUCE WATER! FOR EVERY GALLON OF GASOLINE BURNED, APPROXIMATELY ONE GALLON OF WATER IS PRODUCED IN THE FORM OF VAPOR EXHAUST.—
Fred A. Janke, Oakmont, Pa.

PENNIES HOLD A LOCOMOTIVE! A PENNY PLACED TIGHTLY AGAINST EACH DRIVE WHEEL OF A LOCOMOTIVE WILL PREVENT IT FROM STARTING—
—John Plessner McHenry, III.

Five dollars will be paid for the oddity selected by Nic Sprank as the best of the month. One dollar will be paid for all others used on this page. Send your oddity to Nic Sprank, Editorial Office, Modern Mechanix, 1501 Broadway, New York, N. Y. Source or proof of each oddity must be given. Send all oddities separately, not with other manuscripts or letters.

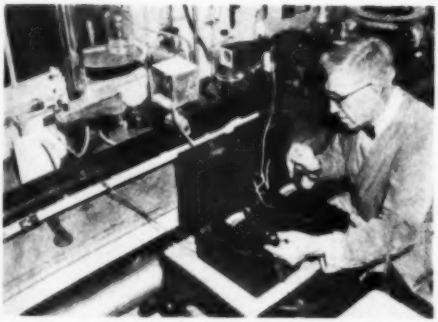
Photo Lens Registers Rays Predating Dinosaurs

BELIEVED by its makers to be the fastest in the world, a new astronomical photographic lens has been used at Mount Wilson Observatory in Pasadena, Calif., for taking pictures of light rays which, scientists claim, left distant stars before dinosaurs trod the earth. In conjunction with the 100-inch reflector at Mt. Wilson, the new lens has photographed spectra of nebulae 30,000 times fainter than the faintest star visible to the unaided eye.

Dr. M. L. Humason, who conducted the Mt. Wilson Observatory tests, reported that the speed of the observatory's spectrograph was doubled through use of the new lens, which has a speed of *F. 0.59*. Astronomical data placed the nebulae observed by Dr. Humason as being an estimated distance of 80 million light years from the earth. Through use of the new lens, scientists can now observe faint objects which have previously been deemed hopeless from an astronomical viewpoint, according to Dr. Humason.

This new photographic lens enabled astronomers at Mt. Wilson Observatory to take pictures of nebulae estimated to be 80 million light years away from the earth. Dr. M. L. Humason adjusts lens, believed to be the fastest in the world.

Compound Irradiates Heat

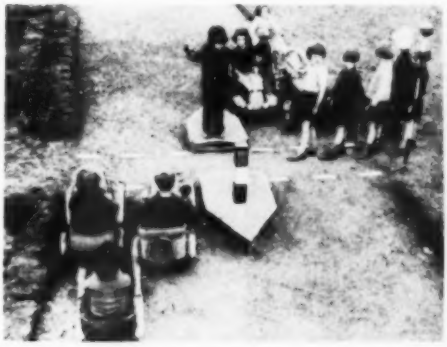


Galvanometer tests of steam-heated cubes, one painted with a new compound developed by W. F. Alder and the other unpainted, indicated that treated cube gave 40 degrees more heat.

APPLIED to a surface like paint, a new compound developed by W. F. Alder, an Altadena, Calif., scientist, is said to possess great heat absorption and irradiation qualities. In tests, galvanometer readings indicated that a steam-heated cube of polished copper painted with the compound had a temperature 40 degrees higher than a similar untreated cube. The compound is being used by California fruit growers to increase the heat given off by smudge pots placed in orchards during periods of frost.

Kiddies Taught Traffic Laws

A MINIATURE roadway complete with signs, stop-and-go lights, crossings and safety zones is being used to teach pedestrian and auto traffic regulations to school children in Brentwood, England. The lessons are made interesting for the tots by letting them drive miniature autos over the "highway," impersonate policemen, etc.



English tots learn traffic rules by means of this "highway."

UNCLE SAM—

MODEL

Top photo—Relief map of Vicksburg (Miss.) National Military Park. Center—Making a model Indian village for use in an historical exhibit. Lower—Pulling the mold from a clay relief map.

by Walter E. Burton

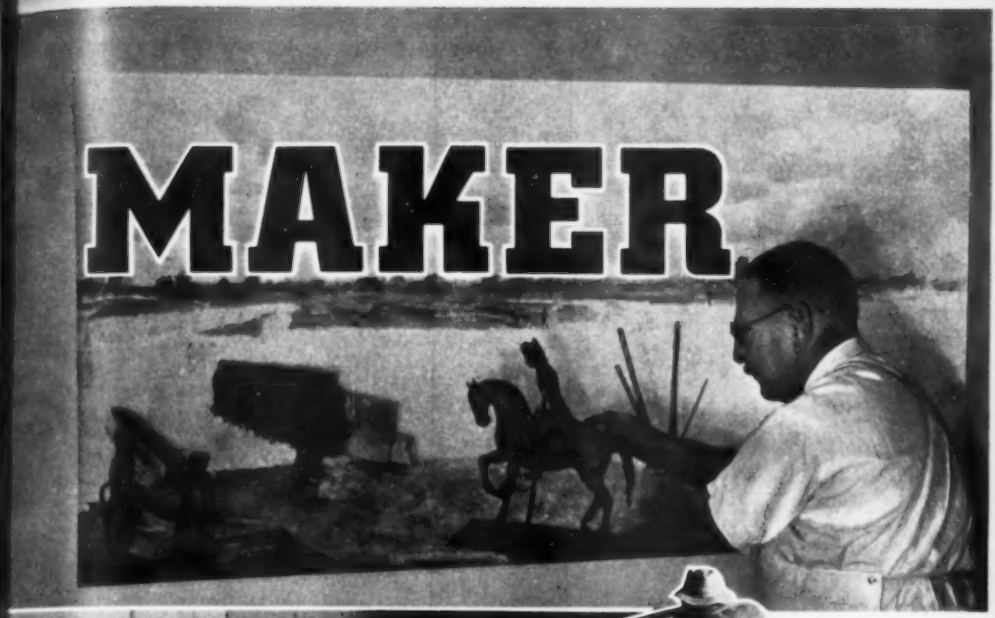
THE man in the lookout station leans forward tensely. His eyes ache as he gazes through his binoculars. Yes, there is a wisp of smoke all right; and it seems to be growing in size. Looks like the fire might be near North Fork.

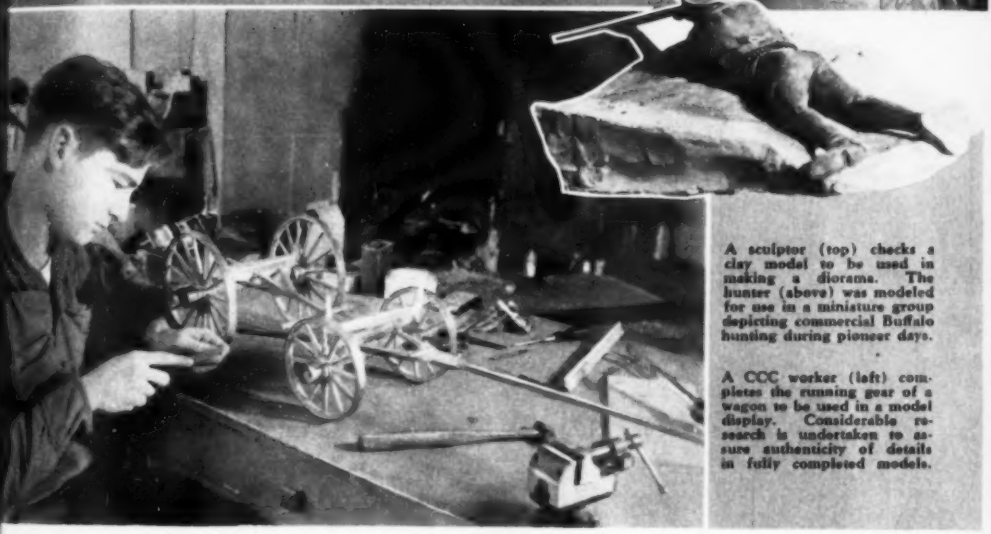
The lookout leaps across the floor to a relief map hanging on the wall. With his pencil he traces a route the nearest fire-fighting crew can take to reach North Fork. Two or three times he has to back up and detour around small, but deep, canyons or small streams whose sides are steep, and which might delay the crew too long. It is but a matter of seconds until he has worked out the shortest and easiest route; and not many more seconds until the men from the nearest station are preparing to depart.

In a few hours, thanks to quick work of the forest fire fighters, thousands of dollars worth of timber, scores of wild animals and perhaps even a number of human lives have been saved from the Fire Demon. But the story might have been different, if that relief

Not child's play, but a

MAKER





A sculptor (top) checks a clay model to be used in making a diorama. The hunter (above) was modeled for use in a miniature group depicting commercial Buffalo hunting during pioneer days.

A CCC worker (left) completes the running gear of a wagon to be used in a model display. Considerable research is undertaken to assure authenticity of details in fully completed models.

map had not been at hand for pointing out the quickest route to the fire.

Behind that map is a story of Uncle Sam as an up-to-date builder of models and manhood. For the map in question is one of the products of government model laboratories operated by Civilian Conservation Corps boys as part of the Emergency Conservation Work program. There are two such laboratories in the country. One of them is at Fort Hunt, Virginia, not far from George Washington's historic home at Mount Vernon. The other is at Berkeley, California. These laboratories carry out projects of model building and relief map making sanctioned by a committee.

The models serve a variety of useful purposes. Perhaps the superintendent of a national park will want a relief map of the park to exhibit to visitors to acquaint them with the topography of the region, or a diorama

valuable service is this branch of government activity.

A general view of a workshop in Uncle Sam's Model Laboratory at Fort Hunt, Va., is shown above. Experienced model makers are in charge.

Model trees (above) are made of permanent materials. Contours on a relief map are developed from heavy cardboard layers, as shown below.

to explain some historic event, or natural or scientific feature. The original relief map of a certain area may be duplicated many times for museums or schools which are willing to pay for the materials required to make the casts. In laying out trail systems and roads through parks or other territory, thousands of dollars may be saved by making preliminary layouts on relief maps instead of making expensive surveys on the actual ground. When working out a fire control system for the protection of a forest area, a relief map is of great value in selecting the most advantageous positions for observation towers, cutting trails, and placing fire-fighting equipment. In reforestation work, a relief map makes it easy to work out a planting schedule, so that trees will be placed where they will thrive best and do the most good. The use of a relief map for helping fire fighters reach a forest fire by the most convenient route already has been described.

But relief maps are not the only projects turned out at the government model laboratories. Carefully-made scale models of historic Indian villages help tell effectively the early history of the country. Sometimes the relief map of a region includes a complete model village or town, each detail, down to the smallest building, being faithfully reproduced to scale. For instance, a model of the Hot Springs, Arkansas region, includes scores

[*Continued on page* 128]

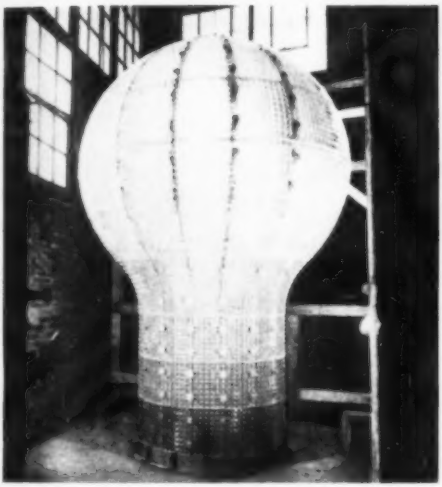
Eye Exerciser Apparatus Resembles Circus Wheel

DESIGNED to strengthen eye muscles through exercise, a new apparatus invented by Dr. William I. Henry, of Akron, Ohio, resembles a carnival chance wheel in appearance. The device consists principally of a large rotating disc to which toy animals are attached in slots in such a manner that they assume different positions as the disc rotates by mechanical means.

To use the apparatus a patient sits before the disc, placing the chin on a special rest. Watching the antics of the toy animals as the disc rotates at various speeds provides exercise for the eye muscles.

Placing her chin on a rest pad and watching antics of toy animals as they pass by on a rotating disc, this young lady indulges in an exercise said to strengthen eye muscles.

Edison Memorial Bulb Ready



Standing 14 feet high with a diameter of 9 feet, 6 inches, this electric bulb will be placed atop Edison Memorial Tower in Menlo Park, N. J. Interior features 960 electric lights.

A GIANT electric light bulb, 14 feet high, which will surmount the $100,000 Edison Memorial Tower at Menlo Park, N. J., in commemoration of the invention of the incandescent lamp by the famous inventor, has been completed. The bulb, in position atop the 150-foot tower, will also serve as an airways beacon.

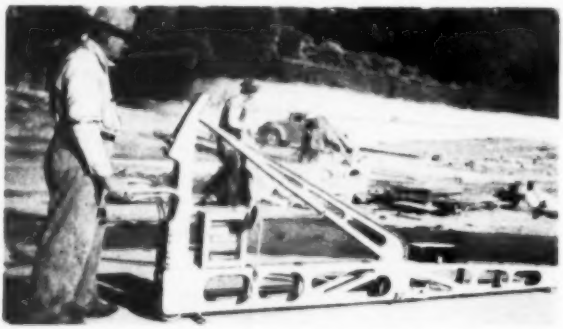
The bulb consists of 164 pieces of glass cast in two-inch diamond patterns around a steel skeleton frame. The interior features 960 incandescent lights and a 24-inch reflector.

Three In Family Blow Glass

A STREET shop in Los Angeles, Calif., displays glass-blown decorative objects created by three generations of artisans—father, daughter and grandson. The grandson, Dick Manley, is only ten years old, but already has four years of glass blowing experience to his credit. Together, they have created an interesting exhibit of the glass-blowers' art which includes objects such as sailing ships, airplanes, animals, candle holders, flowers, trees etc.

Three generations—father, daughter and grandson—of glass-blowing artisans display their craftsmanship in this photo.

"Planeometer" Detects Minute Pavement Deviation



Deviations in highway pavement as small as 1/100th of an inch are readily detected and magnified by this "Planeometer" device, which is used by Oregon State Highway Commission.

ENABLING authorities to check the work of laborers as well as traffic load effects, a "Planeometer" device used by the Oregon State Highway Commission detects deviations as small as .01-inch in any ten feet of pavement parallel to the center line. The machine was invented by W. C. Newell, of Portland, Oregon.

The amount of variation is recorded on a special scale, being magnified four to ten times. A chalk marking device attached to the machine marks the rough spots as they are encountered, enabling work crews to relocate the points of deviation later when repairs are to be made.

Builds Midget Locomotive

A MINIATURE locomotive designed and built by Robert Hunter, of Wilmot, South Dakota, is said to be capable of hauling a train of cars carrying ten persons weighing approximately 1,800 pounds without reducing its power or speed. Mr. Hunter is 50 years of age and constructed the locomotive and cars in his home workshop during spare time throughout winter months.

The miniature locomotive is complete in every respect. Weighing 1,140 pounds, the engine is five feet long and is rated at six and seven-eighths horsepower. Two hundred and forty feet of oval track are used as a "right-of-way" for the complete train.

Transporting his home-built train to fairs and other celebrations, Hunter has developed an extensive business by taking interested spectators for a ride over the oval trackage at ten cents per passenger.

Controlled from its tender, this home-built locomotive has a power rating of 6⅞-horsepower. It successfully hauls a train load of ten passengers weighing about 1800 pounds.

Device Bares Vocal Chords

Angela O'Byrne, voice authority, examines the vocal chords of Thomas Freebairn-Smith, radio singer, with an "autophonoscope" consisting of tiny mirrors in a long tube.

CONSISTING of an intricate maze of hidden mirrors in a long, slender metal tube, one end of which is inserted into the mouth far back toward the throat, an "autophonoscope" device enables voice teachers to peer at pupils' vocal chords while they are in action. Tiny, but powerful, electric bulbs at the tip of the tube provide light within the pupils throat during the examination.

Private Planes And Boats Engage In Sham Battle

A NOVEL sham battle between private airplanes serving as bombers and small cabin cruisers serving as an enemy fleet was recently staged on Long Island Sound. Sacks of flour were used as bombs by the aircraft, while cameras constituted the anti-aircraft defense of the pleasure boats. Swooping low over the zig-zagging motorboats, the airplane pilots dropped their flour bombs, hoping to score a hit on the decks before their planes were "shot" down by the cameras in the hands of the eager boat crews.

Swooping down upon pleasure boats representing an "enemy" fleet, privately owned airplanes dropped bombs, in the form of sacks of flour, during a sham battle on Long Island Sound.

Booth Is Minus Door

A TELEPHONE booth without a door, yet without a disturbing sound, is on exhibition at the Museum of Science and Industry in Chicago, Ill. The doorless booth is made quiet by liberal use of sound absorbent material and is kept cool by perforations in its sides. The sound absorbent material creates a "zone of quiet" inside the booth.

Miniature Autos Exhibited

These young ladies are comparing the craftsmanship of two models entered in a miniature auto show staged in New York.

A MINIATURE automobile exhibition staged at the International Building in Radio City, New York, for the benefit of the Boys' Brotherhood Republic of New York City, featured many excellent models ranging in size from tiny vehicles one foot long to several capable of seating two persons.

Chain Stump-Puller Devised

A POWERFUL, noiseless and hand-operated chain stump-pulling device which uses the principle of the hydraulic jack, has been developed by the German engineer von Nickish-Rosenegk. A steel tripod is set up over the stump to be pulled and chains attached to the stump. These chains fasten into one end of a plunger which gradually ascends, due to the pumping on the handle of the hydraulic jack. A force of over 66,000 pounds thus created pulls out the stumps.

Exhaust Gas Made Harmless

RESEMBLING a muffler in appearance, a device designed for attachment to automobile exhaust pipes is said to burn up carbon monoxide gas before it can escape into the air, thus reducing the danger of concentrated exhaust fumes in garages, tunnels, etc.

The burner contains a special porous earth, to which copper oxide has been applied. The hot exhaust gases mix with air drawn in through a vent in the burner and glow brilliantly as they pass over the copper oxide, which causes dissolution of the poisonous monoxide gas before it is released.

Elevator Garage Stores Auto Under Lawn Of Home

Restricted by law from building a regular garage on his lawn, a London suburbanite solved the problem by installing an electrically driven elevator garage under the lawn. Controlled by switch (center photo), the elevator quickly rises or descends.

LACKING room to build a garage at the side of his home and being forbidden by city ordinance to erect one in front or at the rear, a suburban Londoner solved his problem by installing an elevator garage under the front garden. The elevator is electrically driven and control switches within the house cause it to rise or lower within a few seconds. When in a fully lowered position, the elevator roof is flush with the ground.

Aircraft Has Bird-Like Wings

INSPIRED by the actions of birds in flight, R. Passatt, of Surbiton, England, has constructed a flying machine that features wings shaped like those of the feathered fliers. "The Lark," as the novel aircraft is called, is equipped with a ten-horsepower engine and a propeller which provide forward motion, the bird-like wings revolving rapidly to create vertical flight only.

The wings of "The Lark" are not only shaped like those of a bird, but are covered with a gauzy material which is said to catch the air like feathers do. The entire aircraft weighs only 360 pounds, the motor and wing mechanism being mounted on a metal frame encased in a wooden fuselage.

Presenting a novel appearance, this flying machine features bird-like wings covered with gauzy material to "catch" air.

Hobby Results In PWA Job

HOBBIES sometimes grow into million-dollar projects, as the experience of H. A. Siedelmeyer, a U. S. Forestry Service draftsman, indicates.

Some years ago, Siedelmeyer became interested in building relief maps as a hobby. It wasn't long before the Forestry Service decided that he was just the man to supervise P. W. A. construction of a great relief map of national forests of the west, which will be placed on exhibition at the 1939 Golden Gate International Exposition to be located on a man-made island in San Francisco Bay.

The relief map, which is now two-thirds completed, will be approximately 100 by 150 feet in size and will cost about one million dollars. The map is being built on a scale of one inch to the mile and at the peak of work about 800 persons will be employed.

Railroad Tests Mile-Long Stretch Of Welded Track

ONE of the longest stretches of continuous railroad track—a mile-long pair of welded rails—has been placed in heavy-duty service near River Valley, Pa. With 75,000-pound engines hauling from eight to ten trains a day, each having up to 125 loaded cars, the welded track is being used as a proving ground where American railroads can learn the ability of the novel trackage to stand up under heavy traffic. The cost of maintaining the new type of track will be made available to all railroads.

Welding the sections of track into a continuous unit was accomplished by the thermite process, wherein the rail ends are brought tightly together, placing a mold around the joint, preheating rail ends and generating liquid steel by thermite reaction, letting the molten steel run into mold.

Flexible enough to bend around a 15-degree curve without being fastened to the flat cars, a mile-long continuous stretch of welded track is carried to a Pennsylvania test site.

Fire Box Traps Pranksters

Demonstrated above is a new fire signal box that locks the hand of alarm sender until released by a policeman or fireman with a key, thus deterring the sending of false alarms.

THE sending of false fire alarms by mischievous persons may be eliminated through use of a newly developed call box. To use the device, the sender of an alarm must pass a hand through a special compartment to reach the signal dial. Once the dial has been turned, the sender's hand is locked in the compartment until released by a fireman or policeman with a key.

"Legcuff" Prevents Running

CRIMINALS are prevented from making a break for freedom while being transferred from court to jail through use of a mechanical "legcuff" recently devised. The device permits the prisoner to walk or sit, but locks and holds the leg in a flexed position should he attempt to run.

Simple in construction, the "legcuff" is held to the leg by means of small chains which pass through locks attached to steel bars which are pivoted by a ratchet mechanism at the knee.

Criminals can walk, but not run, when wearing the "legcuff" demonstrated above. Device locks if running is attempted.

COLOR FILMS--

A "HOBBY" INVENTION

AN INTEREST in photography as a hobby is responsible for the development, by two talented musicians, of one of the greatest advances in the photographic field since the appearance of the first camera—pictures in color. Leopold Godowsky, Jr., a pianist, and Leopold Mannes, a violinist, are the young men who have achieved world renown through development of the Kodachrome process, which may revolutionize some phases of the photographic art.

The world today honors them for their contribution to the science of colored photography because, strange as it may seem, neither man happened to like football while attending a school in Riverdale, N. Y. While other students reported for football practice, Godowsky and Mannes spent their time walking over the countryside. During their numerous walks they developed an interest in photography and considered the possibility of photographing, in color, the picturesque woodland scenes they saw during their jaunts.

The crude experiments of their school days led them, 18 years later, to the elaborate Eastman Kodak Laboratories in Rochester, N. Y., where further experiments finally culminated in the production of Kodachrome color film, now available to the owners of movie and "still" cameras. The invitation to use the facilities of the Kodak laboratories was extended to the two hobbyists in 1931 by Dr. C. E. Kenneth Mees, vice-president of the film and camera company, who had supplied materials, apparatus and advice to the experimenters as far back as 1926 during their early research work.

Godowsky and Mannes developed their hobby into an industrial venture of the first magnitude only by hard and never-ending work. During the 18 years before their invention was crowned with success, experiment followed experiment as their enthusiasm surmounted each tantalizing discouragement. Every spare minute between concerts and recitals was given over to study, reading and experimentation. Finally, in 1931, the pull of their hobby became paramount and they laid aside violin and piano for the chemist's test tube.

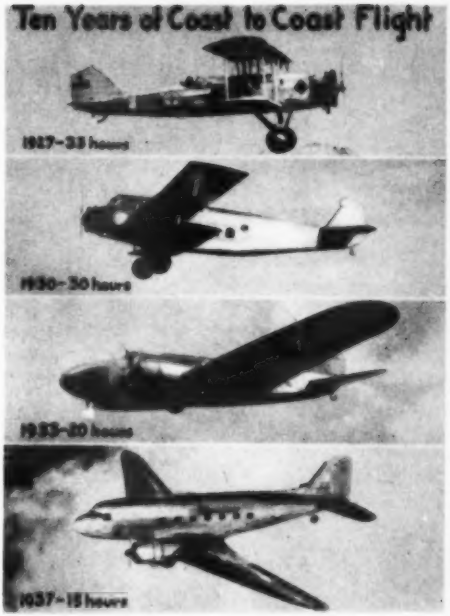
Forsaking the musical field, in which they attained no small degree of success, Leopold Gowdowsky, a pianist (left), and Leopold Mannes, a violinist, "rode" their photography hobby to world renown as the inventors of Kodachrome film. Photo shows the youthful inventors at work in Eastman Laboratories.

Today, the "hobby riders" continue their work as Eastman Kodak Laboratory technicians. Each pays tribute to the efforts of the other and to the assistance provided by fellow workers in the Rochester laboratories. The fruit of their work stands as a monument of inspiration to all other inventors and hobbyists whose work, at first, may not be blessed with success.

Speed Up Of Coast-To-Coast Air Travel Shown

THE tremendous advance made in speeding up commercially operated coast-to-coast air transportation is strikingly portrayed in the photograph at the right, released by United Air Lines. Through development of high speed aircraft, the time required for a transcontinental flight has been reduced from 33 hours to 15 hours, while the ticket cost to passengers has dropped from $400 to $149.50.

The first transcontinental transport planes carried only two passengers in a small, poorly ventilated cabin. Today, club-type "Mainliners" carry 21 passengers in quiet, comfortable salons. Super "sleeper" planes transport 12 passengers in berths larger than a twin bed and provide individual dressing rooms for men and women passengers, while real linens, silverware, etc., give a regal air to meals served aloft.



Progress in transport plane design, with consequent lowering of time required for transcontinental flights, is shown in above photo. Top to bottom—Boeing 40; Boeing 80; Boeing 247; Douglas DC-3. Larger planes are under construction.

Artist Makes Wood Pictures

J. W. Show, a California artist, exhibits one of his unusual pictures made up of bits of untinted wood secured from forests throughout the world. Pictures are ¼-inch thick.

USING bits of wood containing natural colors, J. W. Show, a California artist, has developed a new method of expressing his art. The wood is used to make pictures, each piece being fashioned and placed in position to complete a desired scene. Wood from twenty trees is usually required to complete a picture and months of tedious work are involved in the process.

Build "Mock Up" Air Liners

WOOD, in the form of Douglas Fir plywood, still plays an important part in aircraft production, the principal use of the material being in the construction of "mock ups"—full size models of projected new planes. The "mock ups" provide engineers with a visual reproduction of their plans, enable pilots to test control locations, and help determine seat arrangement, finish, etc.

Before building an airplane, engineers first construct a wooden "mock up" model to determine seating arrangement, etc.

Welded Home Developed

Arc welded together at the factory, this all-steel house is delivered to purchaser by means of a 12-wheel trailer. Fittings, plumbing and wiring are installed while en route.

A NEW development in home construction is an all-steel home which is arc welded together at the factory and delivered to the purchaser in a completely finished condition. The new type homes are of average size and feature three bedrooms, four other rooms and a lengthy central hall.

Plumbing, fixtures, and wiring are installed in the steel homes while they are enroute to the purchaser. Special flat trailers equipped with 12 wheels and pulled by powerful trucks are used to transport the ready-built dwellings to the purchasers' lots.

Machine Air-Conditions Tent

PLACED against the side wall of large tents such as are used by circuses, a newly developed machine blows fresh air, chilled by passing over ice, into the tent by means of a canvas duct suspended over the heads of the audience. Only 200 pounds of ice is consumed by the unit during an average day's operation, it is claimed.

The air conditioning machine is carried on a two-wheel trailer and power for its motors is supplied from the show's lighting plant. When not used for the comfort of patrons, the equipment can be utilized to provide cool quarters for performers, working crews and animals.

No longer need circus patrons complain of the heat within the "big top", for this new machine completely air-conditions tent interior by blowing fresh air through an ice-filled duct.

Airplane Uses Lamp Oil

UNABLE to secure proper fuel for his Diesel powered airplane when he landed at Kabul, Afghanistan, a German pilot tried lamp oil in the engine. The motor worked satisfactorily on the unusual fuel, enabling the plane to make its next flight of 1,000 miles without trouble.

"Stiltmobile" Aids Mailmen

The large wheels on this "Stiltmobile" are said to enable it to travel over roads of heavy mud without becoming mired.

DESIGNED for use by rural mail carriers who must travel over roads which are frequently covered with heavy mud and snow, a new "Stiltmobile" is equipped with greatly enlarged wheels, elevated fenders and a specially designed body.

The odd looking machine is said to travel 20 to 30 miles on a gallon of gasoline. For ordinary transportation purposes, the large wheels and elevated fenders can be removed and replaced with conventional types.

Sea Level Drops Yearly

THE Caspian Sea is three feet lower than it was one hundred years ago, according to a scientist's recent report. The sea has been dropping steadily at an irregular rate, the report states, because the 300 rivers and lakes flowing into the sea do not compensate for losses of water through evaporation.

Addresses of manufacturers mentioned in MODERN MECHANIX can be obtained by sending a stamped, self-addressed envelope to the editor.

Machine Cuts And Blows Hay Into Truck Or Barn

A MACHINE developed by a tractor firm in Milwaukee, Wis., chops up hay and blows it into a barn mow, eliminating the tedious job of removing the hay from a wagon or truck with pitchforks. When placed in a silo, the chopped hay is said to preserve as well as "long" or unchopped hay.

In operation the entire hay machine is hauled to a field by a tractor where a silo-filling unit picks up the hay and deposits it in a funnel-like cutting machine. The cutting machine chops the hay and drops it into a blower device which blows the chopped hay through a pipe leading to a waiting truck. The same blower is then used to blow the hay into barn mows at a later period.

The advantages of stowing away the hay in chopped form lies in the fact that three tons of it can be stored in the same space that one ton of uncut hay would occupy.

Cutting hay into small bits, enabling a large quantity to be stored in a small space, this machine also leads hay into trucks or barn mows by blowing it through a long pipe.

Bus Rider Wears Gas Mask

To eliminate headaches caused by monoxide gas, B. P. Davidson wears a gas mask while commuting to work on buses.

LEADING a campaign to impress local bus operators with the need for some means of eliminating the monoxide fumes that produce headaches and cause passengers to suffer attacks of nausea, B. Palmer Davidson, of Montclair, N. J., wears a gas mask when commuting to his office. The mask is a type used by employees in industrial plants.

Nail Holds Fractured Bones

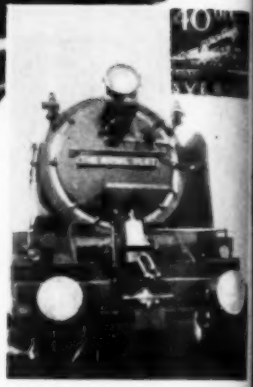
A "hip nail guide," one of the latest appliances used in treatment of bone fractures, was recently demonstrated before members of the American College of Surgeons attending a convention in Chicago, Ill. Constructed of Vitalium, one of the strongest known metals, the device guides a special type of nail accurately and rapidly into a fracture when tapped with a metal mallet. The nail serves to hold the fractured bones in proper relationship to each other during the healing process. A. M. Stephenson, inventor of the new surgical device, conducted the impressive demonstration, aided by a nurse.

Tapped with a metal mallet, this device is used to guide a special nail into bone fractures. Nail holds bones in proper relationship to each other throughout the healing process.

STAMPS AND RAILROAD Anniversaries

by Montgomery Mulford

The modern streamlined train has yet to appear on United States or British issues, but other countries have pictured this modern mode of transportation. The 1936, 40-ore Swedish stamp pictures a streamlined steam locomotive similar to the famous "Royal Scot" at right.



A LARGE number of postage stamps picture railroad subjects, including locomotives and railroad bridges; it is said that there are about 130 types of locomotives shown on issues from all about the world.

Several of these postage issues picturing locomotives were issued primarily to commemorate the first railways; others appeared to mark the international railroad congress meetings. Thus Egypt, in 1933, issued a set of commemoratives showing old and new locomotives—four different styles were depicted on the stamps.

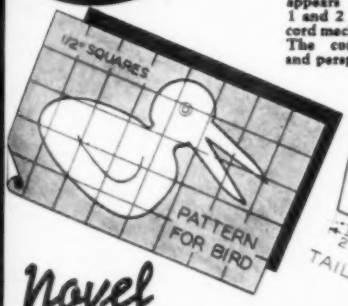
In 1935 Belgium celebrated its first locomotive, issuing stamps picturing the first as well as the latest used in that country. The first one, of 1835, was named "La Belge," and it was pictured on the lower values of the

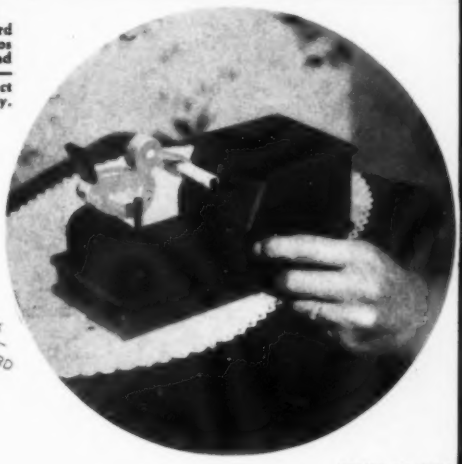
[*Continued on page* 142]

These are but a few of the many stamps issued by the various countries throughout the world to commemorate rail transportation. Left to right are shown the railroad stamps of San Marino, Spain, South Africa, Nicaragua and France

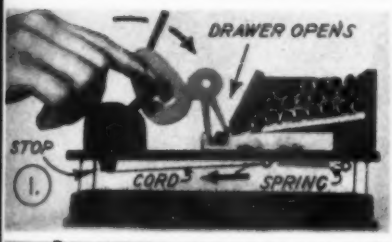
CRAFTS and HOBBIES

Pattern for making bird appears at left. Photos 1 and 2 show spring and cord mechanism. Right—The completed project and perspective assembly.



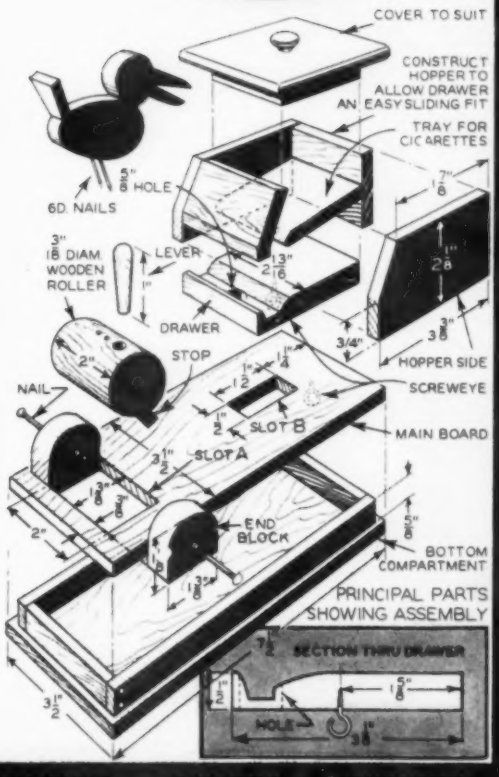


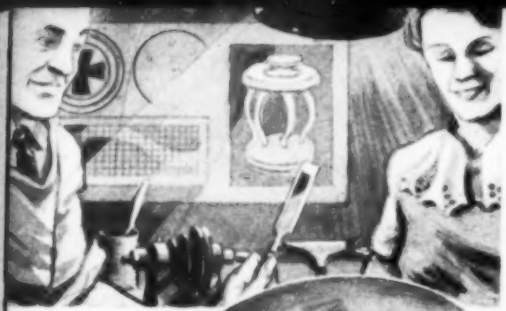
Novel CIGARETTE Automat



YOU probably never saw a real live bird that looked like this one, but then you never saw a real live bird do what this one does. When you want a cigarette he bobs down and comes up with one in his beak, just like that. Unlike most

[*Continued on page* 140]





Completed, the inlaid stool makes a useful living room decoration.

STEPS IN MAKING

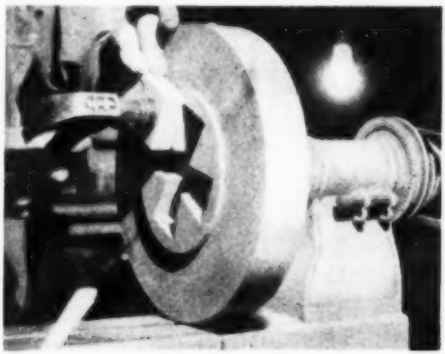
an Inlaid Footstool

by Dale R. Van Horn

FOR your next lathe project, why not make this lovely inlay foot stool? It has an unusual design and the striking contrast between the white pine and figured gum top makes fit addition to any room.

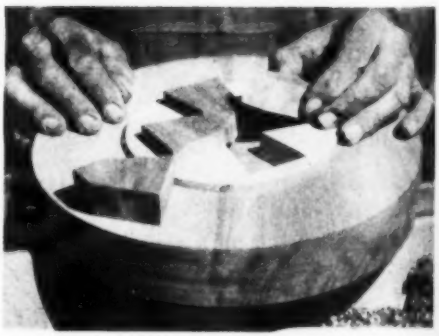
The first step calls for placing the stock, for the top, on the lathe face plate and turning it down to size. The small, center screw type was used throughout this job. Next, the recess in the top side for the white pine disc is cut out, care being taken to have the cut square. The piece is then removed and a block of white pine 1-inch thick cut down to make a tight for the hole.

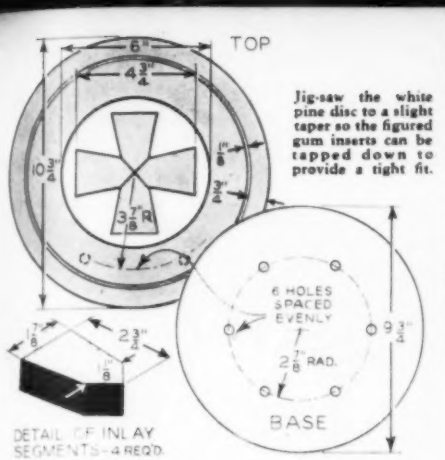
The cross design is laid out on the pine and this jig sawed out with a slight taper—the bottom being very slightly smaller than the top opening. This taper insures a tight glue joint for the inserts when they are tapped home. Proceed by putting the block for the top back on the face plate, wiping glue inside the recess and around the rim of the pine block, then tap home with a block of wood under the hammer. Before doing this a pattern is taken of the insert size. Four pieces are sawed to shape, slightly oversize. These are fitted one at a time, their size reduced by holding them lightly against the sanding disc. Glue holds them firmly in place. All four inserts, however, should be fitted and a trial assembly made first to insure a good fit. While the inlay design shown is simple and of plain lines, any suitable figure can be used, such as the outline of a scottie, swan or some other appropriate design. Scribe a circle to designate the positions of the top leg dowels on the under side, divide into 6 spaces and, with a cloth protecting the top, bore the dowel holes ¾-inch



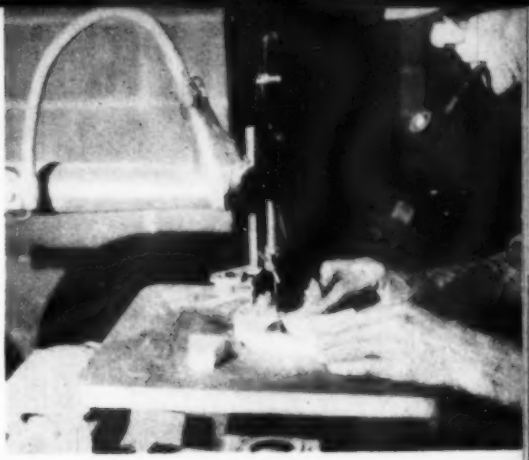
Left — Tap white pine inlay disc in place with a block of wood and a hammer. The glue should be previously applied to the disc so as to hold it in securely.

Below — Fit each piece, inserted in the cross, in the white pine disc individually. After a good fit has been obtained, apply glue to the edges and hammer them down into position.





Jig-saw the white pine disc to a slight taper so the figured gum inserts can be tapped down to provide a tight fit.

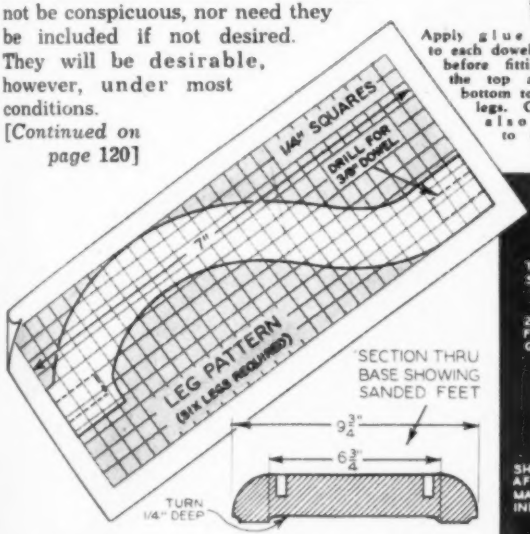


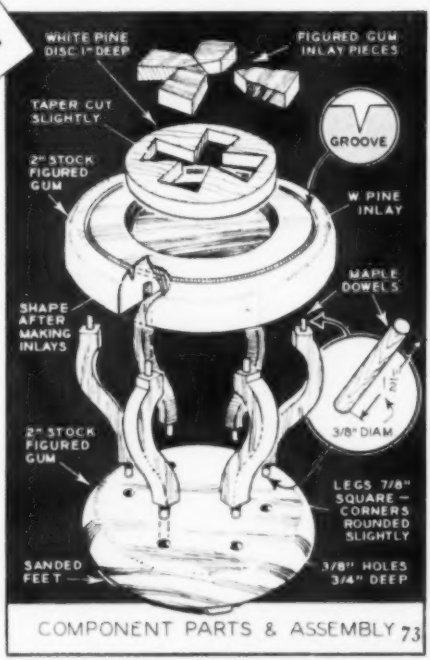
deep. Put the piece back in the lathe and finish with a good coat of clear lacquer. Later rub it lightly with No. 000 steel wool and finally wax.

The base is a simple turning. To get away from such a large piece setting flat on the floor and perhaps teetering a little if the floor is not true, a depression is turned ¼-inch deep in the bottom side of the base. Most of the remaining wide, shallow rim is then sanded away to leave 4 or 6 feet as indicated. These will not be conspicuous, nor need they be included if not desired. They will be desirable, however, under most conditions.

[*Continued on page* 120]

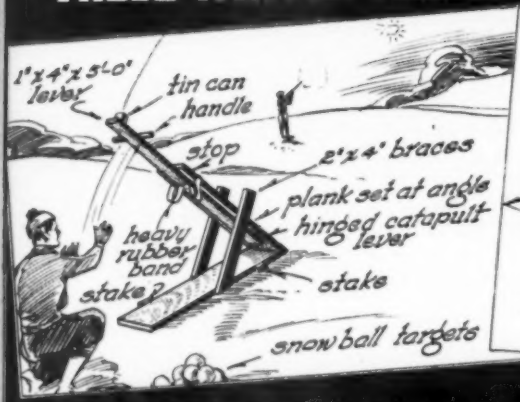
Apply glue to each dowel before fitting the top and bottom to the legs. Glue is also applied to inside of holes.



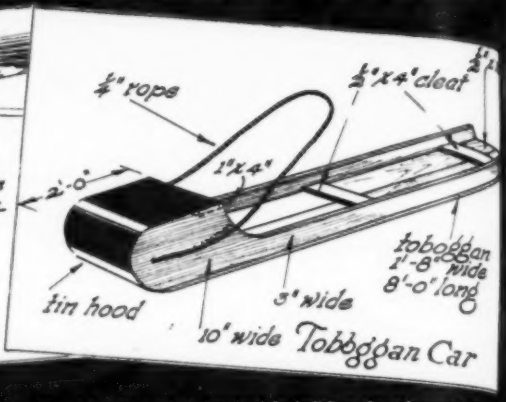


Left — At this stage the top is ready for polishing. The decorative inlay around the edge of the top is a narrow pine strip glued into a "V" groove made with a shaped file tang. Finish the top by applying a coat of clear lacquer. When dry, rub with No. 000 steel wool and last polish with wax.

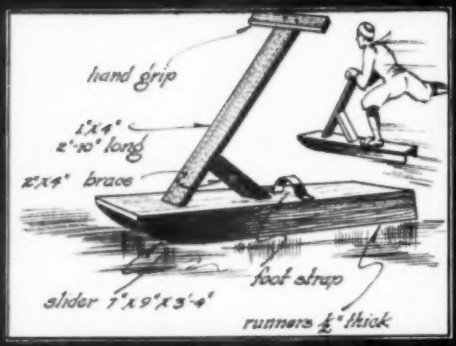
THESE WINTER PROJECTS ARE EASY TO MAKE



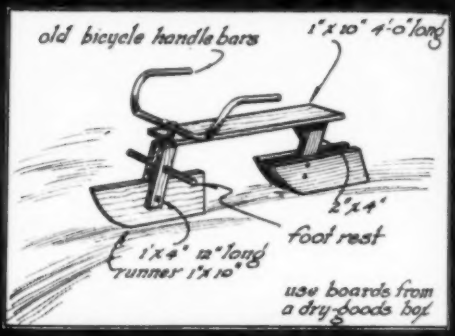
This snowball target thrower permits the trapshooter to continue practice throughout the winter. Construction is of odd planks as shown. A piece of inner tube operates catapult.



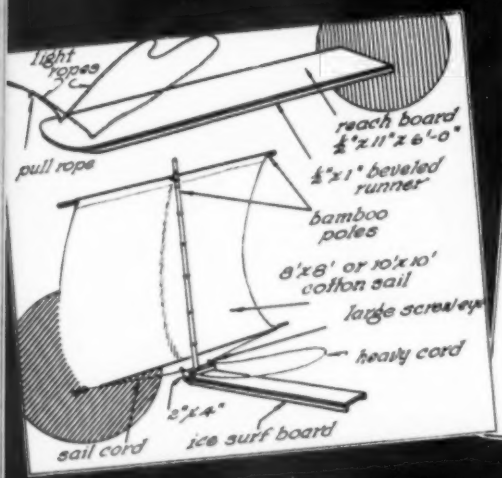
No elaborate work is involved in building the toboggan car described above. Planks 1 by 10 inches form the bottom. The hood is formed from tin. Sides are cut from 1 by 10 inch stock.



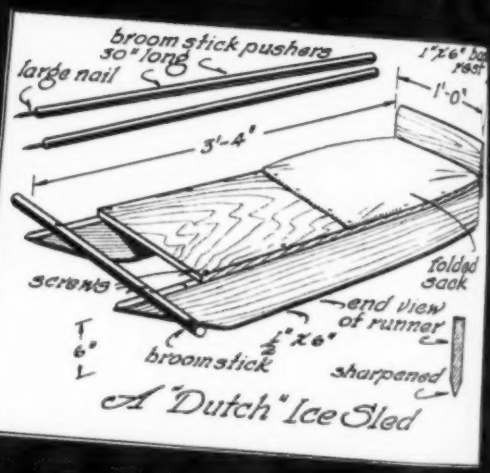
Here is an ice scooter that is simple enough for any youngster to construct. Odd lumber, cut to the dimensions shown, can be utilized in order to keep cost at minimum. To insure rigid construction, all members should be fastened with screws.



Old bicycle handle bars are used for the steering mechanism of this speedy ice coaster. Cut all parts to dimensions shown, making them from hardwood if available, otherwise use packing case material. Plane and sand runners perfectly smooth.



Although extremely simple in construction, this ice surf board will provide endless thrills. Using a single runner, it travels over ice with little resistance. On windy days a simple sailing rig can be added. An old sheet will serve admirably as a sail.



The "Dutch" Ice Sled described in the above detail needs little explanation. Scrap lumber is used throughout in its construction. The occupant seats himself in the sled and uses the broomstick pushers to provide the necessary motive power.

Build This

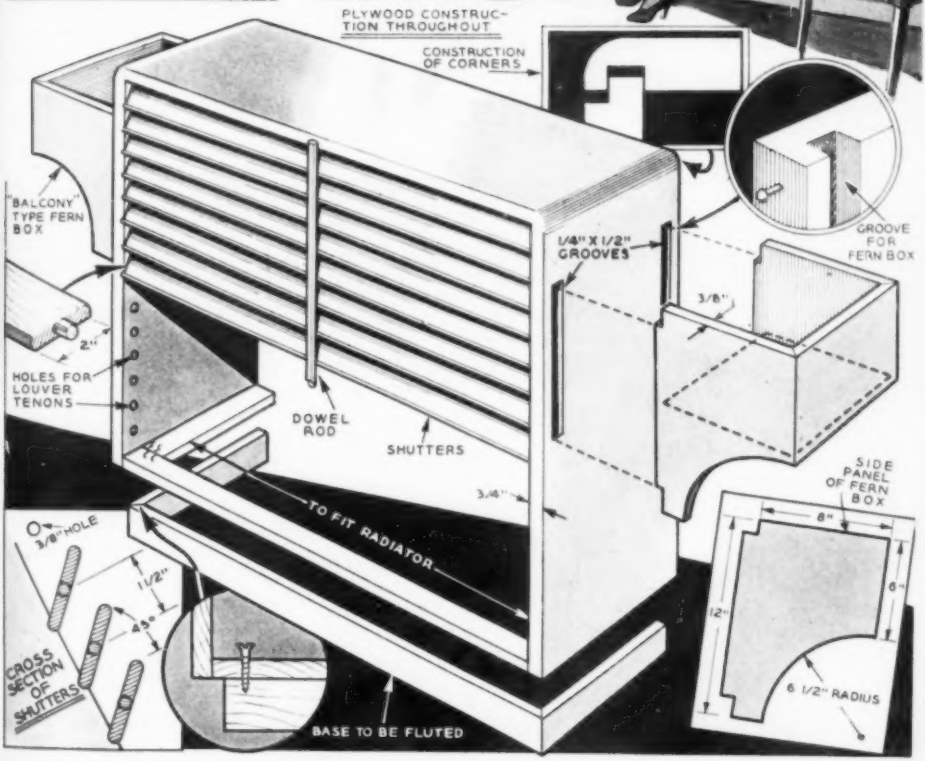
MODERN RADIATOR GRILLE

THE modern grille illustrated in the accompanying details not only serves as a disguise for the unsightly living room radiator, but makes an attractive fernery as well.

The grille is of plywood construction throughout. No dimensions are given, since they will depend entirely upon the radiator over which the grille is to be installed. Three-quarter inch plywood is recommended, although if necessity warrants, lighter stock may be used.

False shutters or louvers made from plywood strips 2 inches wide give the grille a distinctive appearance. Fern boxes of the "balcony" type are secured in grooves at each end. The completed grille should be painted in colors that will match the decorative scheme of the room in which it is to be used.

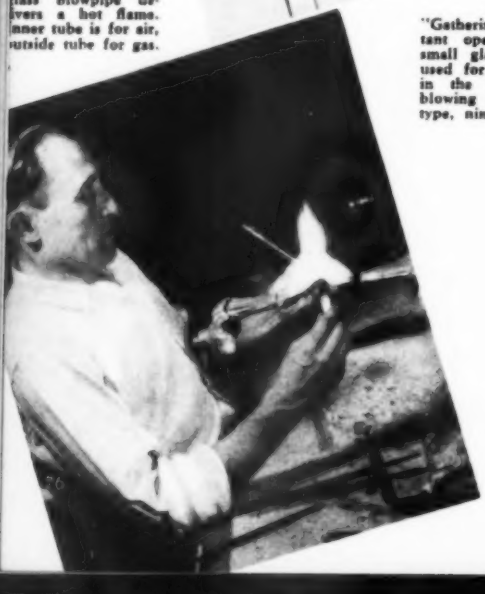
This practical and decorative plywood cover also serves as a home fernery.



You Can Learn GLASS

This home-made glass blowpipe delivers a hot flame. Inner tube is for air, outside tube for gas.

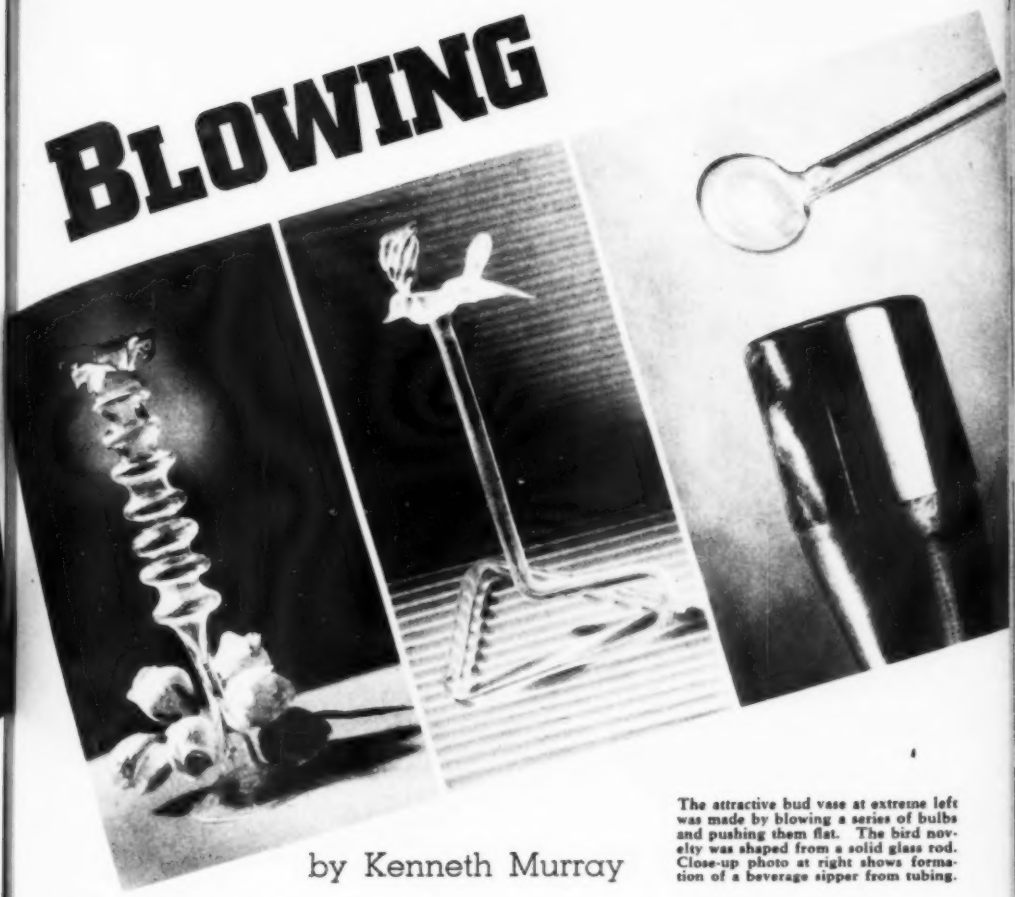
"Gathering" glass is an important operation. Notice the small glass tubes and corks used for holding larger tube in the flame. Left—Glass blowing with a professional type, nine jet gas-air burner.



THE reason that amateur glass blowing is such an interesting hobby is that the work acts as a stimulant to your creative ability. With very simple and inexpensive tools, in a corner of a room or in the attic or basement, you can quickly learn to make dozens of useful and ornamental pieces such as vases, small glasses of different shapes, beverage sippers and other articles of that nature. With further practice and experience you will not find it difficult to make the tiny animal, bird and flower novelties or "what-nots," which are so popular in the home, and know that the design is original and that a similar article cannot be purchased in the stores.

If you are an amateur chemist, a knowledge of glass blowing will enable you to repair broken retorts and other apparatus, in

BLOWING



The attractive bud vase at extreme left was made by blowing a series of bulbs and pushing them flat. The bird novelty was shaped from a solid glass rod. Close-up photo at right shows formation of a beverage sipper from tubing.

by Kenneth Murray

addition to making test tubes and other small equipment. Or do you prefer to dabble with electricity? Then try blowing glass bulbs for homemade experimental electric lamps, along the line of the mercury-arc type of light, which is similar to the well-known "neon" tubes. Amateur model makers frequently have use for miniature glass parts, and in fact there are very few crafts or hobbies where a knowledge of glass blowing would not be useful.

Locate the glass-blowing laboratory in a convenient corner free of drafts and with poor illumination, so that it will be easier to judge the condition of the heated glass. An ordinary workbench, about 3 feet high, is satisfactory, or use a kitchen table. Cover the top with sheet asbestos, or preferably asbestos board, and at the back provide a rack for holding your stock of glass tubing in various sizes.

All amateur glass blowing, and a considerable amount of professional work, is done with glass tubing instead of using molten glass in a heated retort. You will find that soft sodium glass is most satisfactory; it should have walls at least 1 mm thick, and a bore of from 5 to 10 mm for general work. Quite often you can purchase this at a local drug store or high school laboratory, otherwise you can order it of a scientific supply house. Ordinarily the tubing is offered in 5 or 6-foot lengths and costs as little as 25c a pound, according to the amount purchased.

Professional and advanced work is done with two or more special blowpipes which oppose each other and are fed with both gas and air under pressure. A professional outfit of this kind is shown in one of the illustrations. However, the beginner can handle small work with the aid of a bunsen burner

ful flame. Attach rubber tubes with stop-cocks to control the amount of gas and air. The latter can be supplied by a small foot bellows. Adjust the mixture to give a hot blue flame that ends in a fine point.

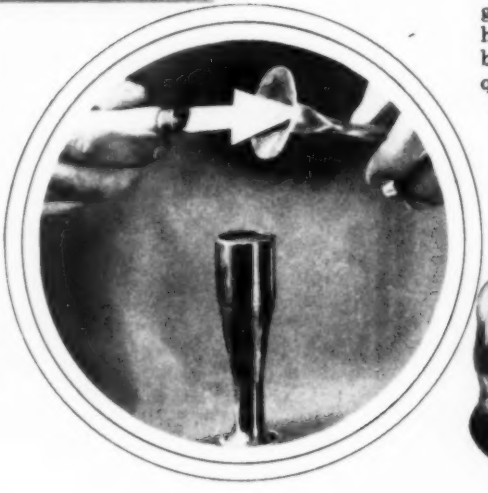
Rotation: In order to heat the tubing evenly it is necessary to keep it revolving in the flame, generally by turning it with the left hand. In case the middle of the tube is being heated, use both hands. This must be done carefully and in synchronization so that the glass does not become twisted.

Ordinarily the professional glass blower heats each end of the tube and draws it off into a narrower tubing, which is broken off to leave a smaller 6-inch spindle at each end. The spindle is much easier to turn than the larger tubing. A more satisfactory method for the beginner is to secure a number of corks in different sizes and drill them to take short pieces of small tubing. These can be inserted in either end of the working tube and serve as removable spindles. Glass is not a good conductor of heat, so the corks will not become charred.

"Gathering" Glass: This is a most important operation for the beginner to learn. Possibly you have tried your hand at glass blowing in the past and have given it up because on blowing the heated tubing it quickly expanded into a

[*Continued on page* 128]

After blowing a series of bulbs in the tubing that will form the bud vase, proceed by heating the end and flaring. Use a putty knife ground into a triangular shape for this operation. Use the corner of the tool to form the flutes, as shown.



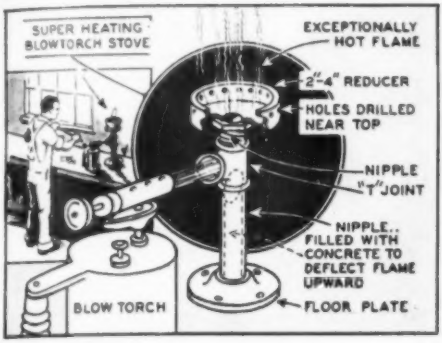
After heating the end of the bud vase, gradually force the flaring tool into the tubing with a twisting motion. This work must be done over the bunsen flame as depicted at right.

Beverage sippers made in the home workshop find appropriate use as prizes for bridge parties or social gatherings.

such as those used for chemical experiments. The larger size, like the one shown in use by the author, will afford a much hotter flame and is to be preferred. It is also supplied with extra gas jets of different sizes, which allow some degree of control over the gas-and-air mixture. If the mixture is too rich there is the possibility that the glass will become darkened as it is heated.

If you should wish to construct a professional-type blowpipe at once, you will find that one made entirely of glass gives a very power-

Pipe Fittings Make Blow Torch Stove For Home Use



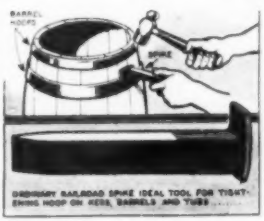
A BLOW torch is a great convenience in the home workshop, and at times is a very necessary piece of equipment. The two-inch nipple connected to the floor plate should be of sufficient length to make the opening into which the flame is pointed the correct height. The torch will throw an exceptionally hot flame upward.

Tobacco Can Makes Swab

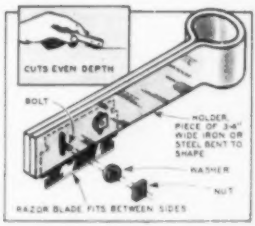
INSTEAD of using an expensive paint brush for paint remover, an empty tobacco tin with the help of small pieces of cloth or burlap will do the job just as well and far more inexpensively. Any loose heavy cloth will do to fill the can. After it is in position, the end of the can is hammered to hold the cloth tightly in place.

Spike Tightens Barrel Hoop

A RAILROAD spike is a handy tool for lightening loose hoops on barrels. The spike in its regular form is shaped so that no further work on it is required. In use, the head is placed on the edge of the hoop to be tightened, and struck forcibly by a hammer.

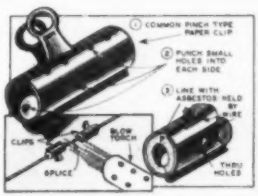


Blade Holder Gives Even Cut



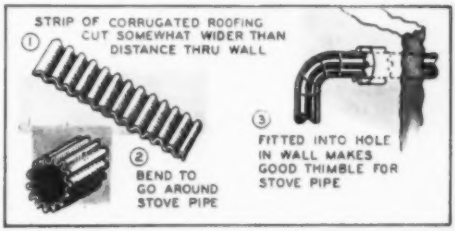
THE safety blade holder shown in the drawing will be found to be a most useful device for the home workshop, inasmuch as it can be adjusted to make any depth of cut from the thickness of a piece of paper to one-quarter of an inch. Any convenient piece of strap iron, steel or brass may be used.

Paper Clips Aid Soldering



ORDINARY paper clips of the spring variety, when prepared as shown in the drawing, make it possible to solder wires close to insulation without burning. Several thicknesses of asbestos should be used to line the clips.

Roofing Holds Pipe In Place


STRIP OF CORRUGATED ROOFING CUT SOMEWHAT WIDER THAN DISTANCE THRU WALL
1
2
BEND TO GO AROUND STOVE PIPE
3
FITTED INTO HOLE IN WALL MAKES GOOD THIMBLE FOR STOVE PIPE

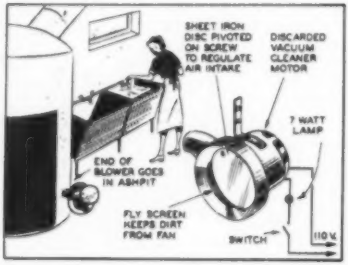
WHERE stove pipe runs through a partition, ceiling or floor, it is advisable to have an air-cooled thimble around it to eliminate possible fire danger. A strip of corrugated roofing, cut slightly wider than the depth of the hole in which it is to be used, will end danger and present a good appearance.

PRACTICAL HOME SUGGESTIONS

Special Putty Repairs Leaded Glass

THE constant opening and closing of doors fitted with leaded glass windows, often results in the glass cracking during cold weather. Such breaks can be repaired so as not to be noticed by simulating the lead with putty.

Make the putty from either commercial white lead and a good grade of whiting or from pure linseed oil and whiting to which has been added enough lampblack to give the mixture the dull gray color of lead. Apply the putty to both inside and outside of the window so glass will be held secure.—G. H. T.

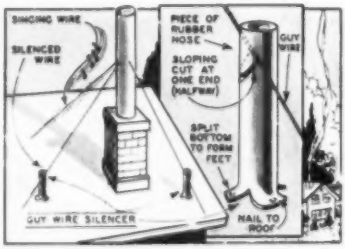

SHEET IRON DISC PIVOTED ON SCREW TO REGULATE AIR INTAKE
DISCARDED VACUUM CLEANER MOTOR
7 WATT LAMP
END OF BLOWER GOES IN ASHPIT
FLY SCREEN KEEPS DIRT FROM FAN
SWITCH
110 V.

Vacuum Cleaner Aids Furnace Draft

AN EFFICIENT blower for home furnaces that do not draft properly can be quickly assembled from the motor and fan mechanism of an old electric cleaner. Remove the unnecessary parts from the motor and mount to the side of the furnace with a strap iron bracket. A hole cut in the side of the furnace allows for insertion of blower end of cleaner. Draft is regulated by a metal disc attached over the vacuum fan. A 7-watt bulb in series with motor prevents it from running too fast.

Rugs Made From Cast-Off Clothing

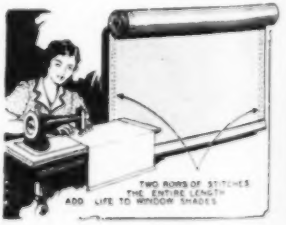
MANY housewives are finding a new use for cast-off clothes by converting them into attractive throw rugs. The old clothing is cut up into strips about 1 inch wide, then wound on a length of stiff wire bent into a U-shape. The base of the rug is cut from burlap and the strips sewed fast on a sewing machine. As each strip is secured, the wire is pulled out and the operation continued until rug is completed.—Mrs. E. R.



Hose Silences "Singing" Guy Wires

GUY wires such as used to support chimney stacks often produce an annoying buzzing or singing sound on windy days. To overcome this simply cut several pieces of garden hose about 1 foot long, slotted at one end to allow for the insertion of the guy wire. The opposite ends of hose sections are tacked to the roof.

Stitches Add Life To Window Shades



AFTER being in use for several months, the cheaper grades of roller type window shades usually show wear at the edges. Any housewife having access to a sewing machine can avoid expense for new shades by sewing parallel stitches along both edges of fabric with thread matching color of shade.

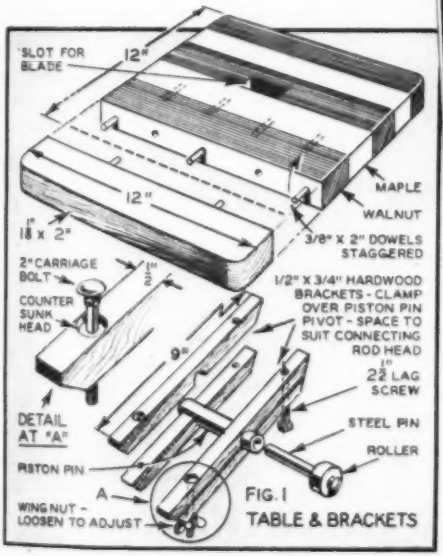
BUILD THIS STURDY 12″ Band Saw

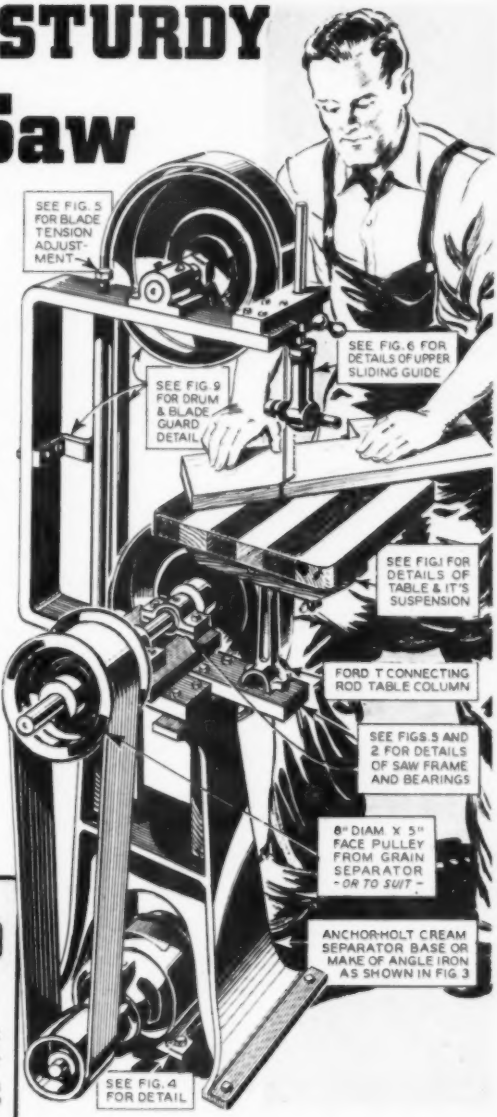
by Melvin A. Noecker

and Douglas P. Rolfe

THIS saw is built to standard size, handles any wood up to 6 inches, and cuts to center of a 24-inch circle. It has adjustable blade guides above and below the table and the table itself may be adjusted to any angle. The operator is protected by a 2-inch guard which covers all but the exposed working portion of the blade.

The saw illustrated cost the designer only ninety-five cents to build! This, the sole expense, was incurred for the ½ by 78-inch blade, the remainder of the parts being taken from old cars and obsolete farming machinery. As some of these parts may not be available to prospective builders, the drawings show substitutes in certain cases. Anyone with an ingenious turn of mind can probably equal or even better these with the material available in his own locality.




SEE FIG. 5 FOR BLADE TENSION ADJUSTMENT
SEE FIG. 6 FOR DETAILS OF UPPER SLIDING GUIDE
SEE FIG. 9 FOR DRUM & BLADE GUARD DETAIL
SEE FIG. 1 FOR DETAILS OF TABLE & IT'S SUSPENSION
FORD T CONNECTING ROD TABLE COLUMN
SEE FIGS. 3 AND 2 FOR DETAILS OF SAW FRAME AND BEARINGS
8" DIAM X 5" FACE PULLEY FROM GRAIN SEPARATOR - OR TO SUIT -
ANCHOR-HOLT CREAM SEPARATOR BASE OR MAKE OF ANGLE IRON AS SHOWN IN FIG. 3
SEE FIG. 4 FOR DETAIL

This illustration shows the band saw as it looks when completed. Details of the parts indicated are described on the ensuing pages. Left—Perspective plan of saw table.

Start with the base. In studying the drawings and photographs you will observe that two types of base frames are illustrated. The Anchor Holt cream separator base used in the original is fine if you can get hold of one handily, but the angle iron type shown in Figures 2 and 3 will prove equally satisfactory and is, moreover, quite easy to construct.

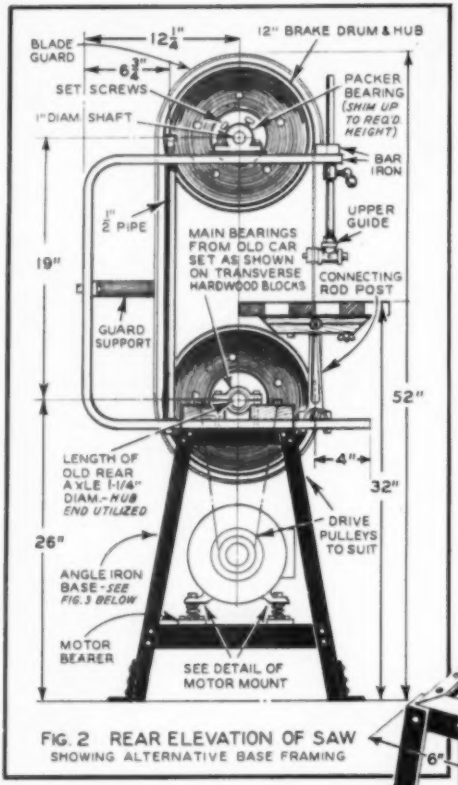


FIG. 2 REAR ELEVATION OF SAW
SHOWING ALTERNATIVE BASE FRAMING

which hold the tension adjustment pipe in place. The ⅝-inch tap occurs at the top of the frame as shown. The exact purpose of this pipe and the manner of fitting it will be explained later. In the meantime, tap as mentioned and the frame is ready to set up on the base.

The frame and a 9-inch length of ¾ by 2-inch bar iron rest parallel, directly on the base as indicated. Across them are placed two timbers which carry the main drive bearings. As the exact size of these timbers depends upon the style of bearing obtained, the dimension will have to be fitted to the job. It must result in the 19-inch dimension given between centers of the band wheels and, as the bearing blocks referred to are bolted clear through the bar iron members into the top rails of the base, it will be necessary to decide upon the main shaft bearings before bolting the saw frame down.

A length of old rear axle sawed off, retaining the hub end, makes a good main drive shaft. Two main bearings from an old car

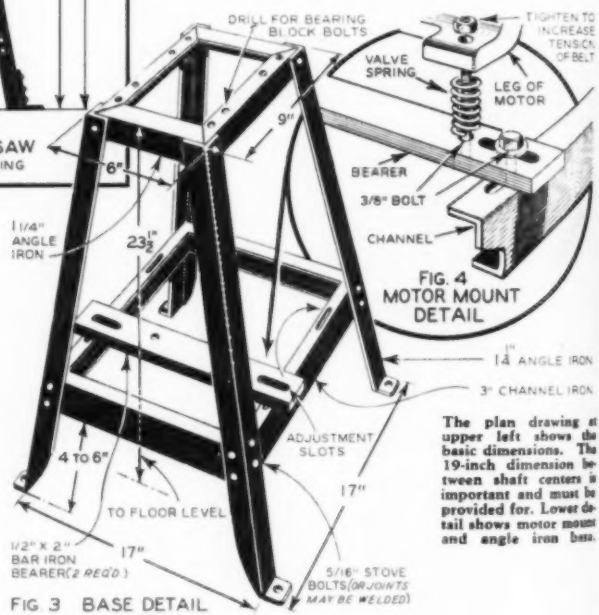


FIG. 3 BASE DETAIL

FIG. 4 MOTOR MOUNT DETAIL

The plan drawing at upper left shows the basic dimensions. The 19-inch dimension between shaft centers is important and must be provided for. Lower detail shows motor mount and angle iron base.

If this base is anchored solidly to the floor the legs may be given considerably less spread, making it still easier to build. The frame is either bolted or welded together. Note that the top rails are mitered at the ends.

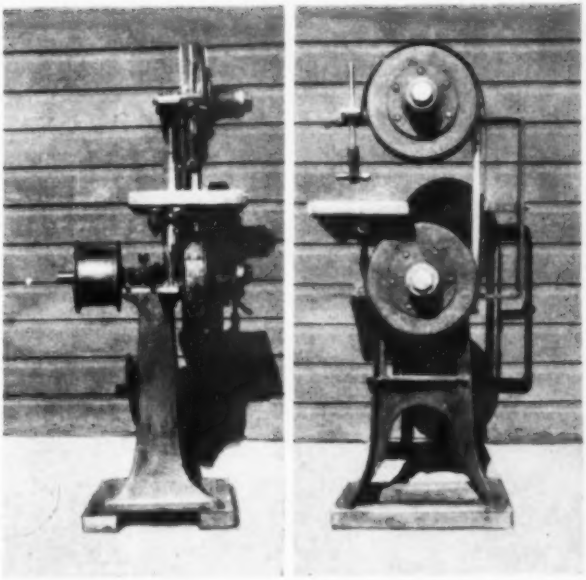
The saw frame on the original was taken from an old gang plow. However, it is simply formed from ordinary ¾ by 2-inch bar iron to the dimensions given in Fig. 5. When obtaining the bar iron enough should be purchased to cover the other frame components as shown in Fig. 5. Slots are cut in the saw frame to permit adjustments of table column and guide arm units, also, although not shown, for the upper shaft anchorage. Exactly 6¾ inches from the U end of the saw frame, are drilled and tapped for the ½-inch and ⅝-inch bolts engine will serve for the bearings of this shaft. (Ford T bearings were used on the saw depicted here.) The bearings are bolted, as shown, to the hardwood timbers or bearing blocks; the exact width and height of these blocks depends, as already stated,

upon the type of bearing used.

The band wheels are 12-inch brake drums complete with hubs, in this instance from an old Elgin car. They are faced with rubber taken from an old, large inner tube (see Fig. 8) and mounted with the flange side facing the frame. The lower drum is fitted directly to the axle shaft that forms the main drive shaft of the saw. This presents no difficulties at all, but the mounting of the upper drum is slightly more complicated.

The upper wheel is supported by a 1-inch shaft which is threaded on one end. The shaft passes through the ball bearing (which in this wheel is retained) and is clamped to the inner race by means of a nut and washer on either side, the ball bearing being held in place by the outer hub. The drum now revolves freely on the shaft, which in turn is anchored to the frame either in the

[Continued on page 124]



The simplicity of the band saw is verified by these pictures showing both front and side views.

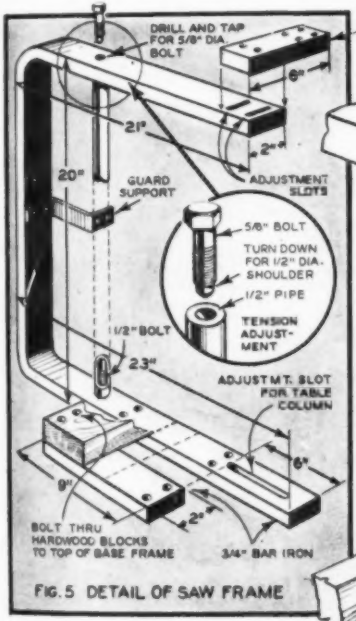


FIG. 5 DETAIL OF SAW FRAME

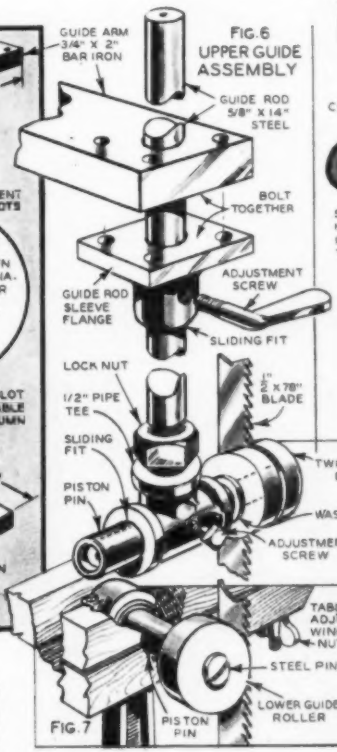


FIG. 6 UPPER GUIDE ASSEMBLY

FIG. 7

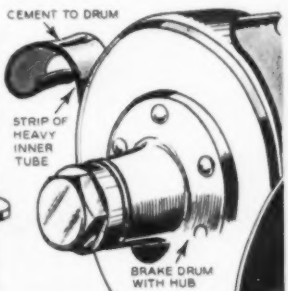


FIG. 8 DETAIL OF BAND WHEELS

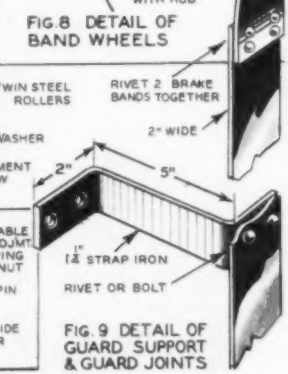
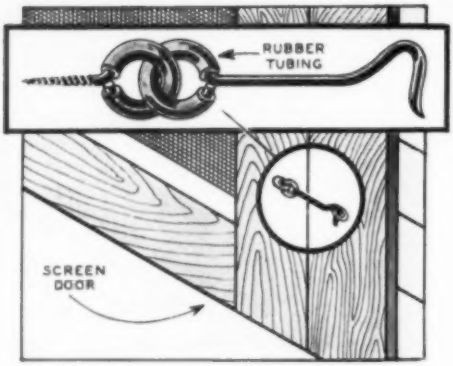


FIG. 9 DETAIL OF GUARD SUPPORT & GUARD JOINTS

Frame dimensions and miscellaneous details of the band saw fittings are shown in this group of details. The manner in which the lower guide roller and piston pin projects from the saw pivot is shown in Fig. 7 insert.

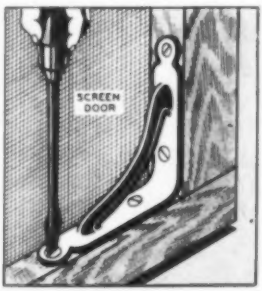
Tubing Gives Spring To Hook



SCREEN doors can be kept closed more tightly if held with these spring-acting hooks. The screw eye and the eye on the hook are spread open to permit a short piece of rubber tubing to be slipped over them. In use, the two rubber covered eyes give a spring-like action to the hook.

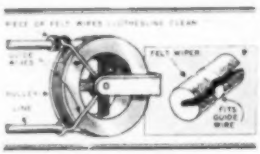
Bracket Strengthens Door

A SUITABLE repair for shaky and sagging doors can be made by fastening ordinary brackets to the inside corner of the door as shown in the drawing. The bracket should be slightly narrower than the thickness of the door frame so that there will be no projection to spoil the appearance of the door or to catch on clothes as persons pass through. This same arrangement may be used to good advantage on other wood frames.



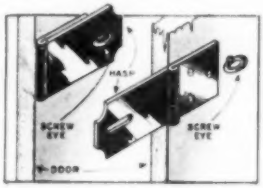
Felt Cleans Clothes Line

A DOUBLE clothes line that has wire guides circling the line to keep it on the pulley can be kept clean if equipped with this simple felt cleaner. It consists of a round piece of felt slit to the center with a small groove around it to hold the cleaner in place.



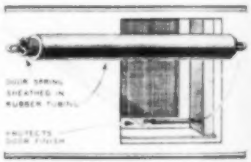
Screw Eye Ends Hasp Danger

SWINGING lock hasps constitute a constant danger to clothes, and at times have caused serious injury to persons running into them. This danger can be eliminated by a screw eye placed so that it will fasten the hasp out of the way when it is not needed. The screw eye should be placed so that the hasp can be folded back out of the way with the eye passing through the hasp opening. By twisting the eye slightly, the hasp will be locked securely out of the way.

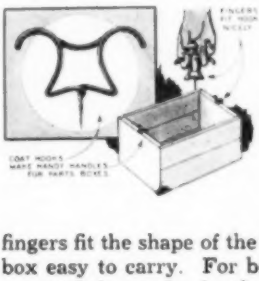


Tubing Protects Door Finish

MANY times the spring on a screen door is placed so that it rubs and scrapes the finish on the door when it is opened and closed. This can be stopped by stretching a short length of rubber tubing over the spring, thus offering complete protection for the finish. This tubing also will prevent small children from getting their fingers caught between the coils.



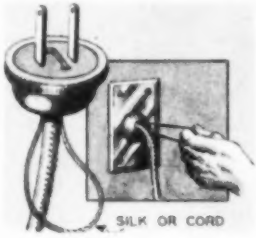
Hooks Form Box Handles



BOXES can be lifted and moved easily about the home or shop if equipped with common coat hooks as shown in the drawing. The first three fingers fit the shape of the handle, making the box easy to carry. For boxes holding heavy material, larger hooks should be used.

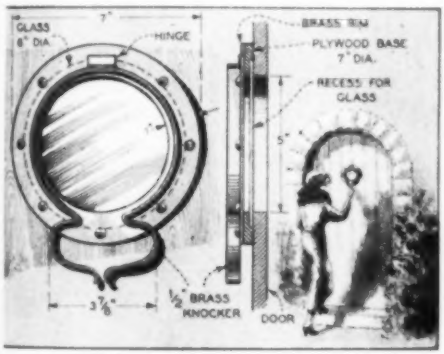
Pull Loop Saves Cord Wear

MANY poor connections in a separable plug can be traced to the fact that the plug has been removed from its socket by someone using the cord as a handle. If a piece of linen cord or string is used instead, the problem of poor connections will be removed. To attach this cord to the plug, make two small holes in the fiber cover which fits over the prong connectors. Then thread the cord through these holes and out through the hole in the rear of the plug used by the wire.



A Port-Hole Door Knocker

THIS door knocker has a useful as well as decorative purpose on any house, because it not only notifies the householder that someone is at the door, but permits the person knocking to be seen before the door is opened. The circular brass rim is cut from medium gauge brass, seven inches in diameter. The handle is a strip of brass, one-half inch wide and five and three-quarters inches in diameter, with the center flattened at the top. The ends are bent so as to produce a graceful appearance. Cut out a base from plywood, one-quarter inch thick, and seven inches in diameter. Turn down the back to form a depression equal to the thickness of the pane of glass to be mounted in the base. This glass should be about six inches in diameter, while the opening in the door should measure about five inches. Drill holes in the brass rim three-eighths-inch from the outer edge so that the screws will clear the glass. Solder a small brass hinge to the handle and to the port-hole rim for mounting the knocker.



Sander Aids Sticking Door

DOORS which do not open and close readily because they rub on the floor usually must be taken off their hinges before a sufficient amount of stock can be removed to eliminate the difficulty. However, with this device, the necessary amount can be taken off without removing the door. The flat piece of wood for carrying the sandpaper should be thin enough to be inserted between the door and the floor at its widest point. Although almost any type handle can be fitted to the device, the handle from an old plane will be found most suitable. To prevent marring the painted or varnished surface of the door as the tool is moved back and forth, a thin strip of wood is clamped along the edge.

Pipe Tee Forms Floor Flange

OLD pipe tees can be converted easily into efficient floor flanges for attaching a pipe to a floor or wall when regular flanges are not available. It is necessary only to saw the fitting as shown in the drawing. Drill holes at each end of the tee for the mounting screws. Flanges made in this manner are especially useful when a pipe must be mounted at an angle to the floor or wall. By careful planning, the tees can be cut so that when set in place the threaded hole will extend in the required direction.

HOME SCIENCE

by Prof. Victor Lewitus

Make a strong soap solution by mixing shaving soap and water. After taking a puff on a cigarette, blow the smoke through a bubble pipe to make a soap bubble. The inside of the bubble then will contain the white smoke, and when it breaks, it does so with a puff, furnishing a very striking experiment. A clay or corncob pipe will be more suitable than the briar variety, inasmuch as the soap mixture probably will make the pipe unsuited for further smoking.

Into a narrow bottle place a few crystals of copper sulphate or "bluestone." Cover these with a few inches of water. Then add several pinches of soap chips and shake the mixture for an instant. It will be found that a beautiful emerald-green solidified mass develops. This is caused by the soap solution reacting with the copper sulphate, which has an acid reaction.

Into a glass of water place two teaspoonsful of bicarbonate of soda (baking soda). After it has dissolved, add one or two teaspoonsful of soap chips, which should be dissolved before proceeding with the experiment. Finally add some ordinary vinegar and notice the thick, voluminous foam that forms. This type of mixture may be used to extinguish a fire, and is very successful because of its tenacious character. If a sufficient quantity is available it will act as a blanket covering the burning area.

Below—Fill three drinking glasses of the same size half full of water. Use ordinary tap water in the first; the same water for the second into which has been placed some salt; and distilled or rain water for the third. Place small equal quantities of soap into each glass of water and shake each for the same length of time. Notice that a thick lather will form quickly in the distilled or rain water while practically no suds will appear in the salt water. The tap water probably will have suds but not as many as in the rain water. This experiment will show the softness of tap water as compared to the other extremes.

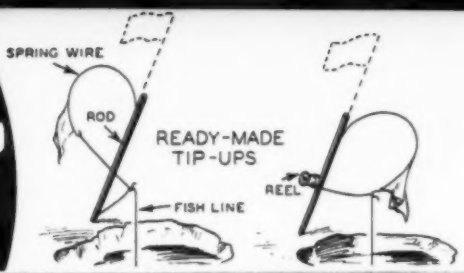
STUNTS with SOAP

FOOLING YOUR FRIENDS

Place two quarts of water in each of two pans and add some salt to one of them. Ask someone to wash his hands in the water to which salt has been added. He will find that try as he will, no lather will form, while if you wash in the plain water, an abundance of lather will be obtained.

Below—Into a small glass receptacle place two ounces of water. Then pour into the water a half an ounce of mineral oil. Shake the combination and note that within a short time after the shaking, the oil and water will separate. Add one ounce of soap chips to this solution, and this time after shaking, the oil and water will not separate. This shows that oil and water will mix under the proper conditions.

This burn-aid soap will be found to be a very useful preparation to have on hand in the home at all times. Children particularly are subject to many minor burns, and because of the pink color of the material, they probably will have no objections to having it applied when necessary. Into a glass vessel pour three ounces of lime water (obtainable at the drug store). Add to this, with constant stirring, linseed oil until you have incorporated three ounces. Mix thoroughly by shaking, in a six- or eight-ounce bottle. During the shaking, the material will turn to a milky-appearing substance. To this add about ten drops of mercurochrome solution (obtainable at the drug store). This last addition will turn the solution a pink color. These simple experiments will be found interesting and simple for the amateur chemist, and give to the experimenter a broader knowledge of soap—one of the most common and useful things in life. While in continual use by every person, few understand its workings other than for washing purposes.



The ice fisherman's gear need not be elaborate. All essentials are shown above. Fishing can be done, mechanically, with "tip-ups," or hand jigging, as pictured at right, may be employed.

Landing Your Fish

FROM our northern snow-belt states, up through Canada and even Alaska, ice-locked rivers, ponds and lakes are dotted in winters with men and fishing outfits. Even snow and bitter winds driving over their frozen surfaces fail to chill the enthusiasm of inveterate fishermen.

Despite conservation legislation limiting catches and shortening fishing seasons, interest in the sport is definitely on the increase. Many mere onlookers of a Sunday afternoon return the following week-end with the sketchy outfit required to try their skill at ice fishing. Good luck or bad, they usually succumb to the multiple lures of keen frosty air, the contrasting beauty of black evergreens against snow-blanketed hills and the exhilarating feel of lively perch, pike and pickerel tugging against a taut line.

Some of the charm of ice fishing lies in its uncertainty. One day you may pull a good string from a single hole, but catch nothing when you hurry back to it the next morning. Fishermen on one side of a pond may be seen frantically pulling in perch, hand over hand, while less fortunates on the other side flail idle hands and stamp cold feet in an effort to keep warm.

Familiarize yourself with the laws of your particular state as regards ice fishing before gathering your gear together. Yellow perch, pike, pickerel, whitefish, grayling, bullheads, lake herring and trout, and others, may be taken through the ice—if your particular state permits. Even the methods used—the jigging spoon, tip-ups, "plunking" for ciscos and spreader fishing for smelts—the subject to our everchanging legislation.

Ice fishing tackle is characterized by its simplicity. The majority pin their faith to "tip-ups," either buying excellent ready-made affairs at reasonable prices or patterning their own after one or another of the many amateur designs.

The ribs from an old umbrella may be used to help make the half-dozen "tip-ups" required. A lath, not quite as long as the rib, is used as a wood support, notched at one end and the rib hung in the groove there by driving a rivet through the side of the notch and on through the hole in the center of the rib to form a T-like affair. The line is tied to one end of the rib and over the other is

slipped an adjustable weight such as a lead bullet slug, the rib tip being bent to prevent it from slipping off. The weight should be just sufficient to balance the pull of the set line. A "tell-tale" flag of cloth is tied (preferably to the weighted end) to signal the fisherman of a bite.

The support is shaped from a thin 3-inch board, 20 inches long. This is whittled roughly into a wedge-shape and a 1-inch hole bored three-quarters of the distance from the larger end. A ½-inch peg, driven to a tight fit through a hole in the smaller end, permits winding the line for adjusting to the depth of the water being fished, while the "tell-tale" threads through a hole in the other. Use 2-foot broomstick-like poles, with a loose fit through the center hole, for cross arms, so as to lighten the weight of gear to be carried.

A tip-up can be made at the pond by lashing two lengths of sapling together in the form of a cross. Tie the line to one end and fasten a handkerchief to the longer length. The disadvantage is that the cross arm may

JIGGING ROD AND SPOON
HOLE OR GUIDE
CLEAT
BAIT WITH MINNOW, RED YARN OR USE ALONE
GANG HOOKS
MOLD FOR POURING BLOCK TIN
JIGGING ROD MADE FROM THE LEG OF A CHAIR
PART OF RUNG LEFT ON

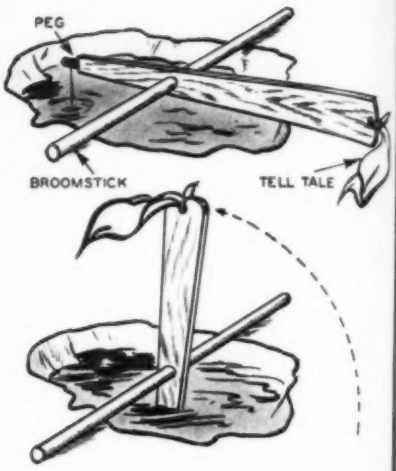
A jigging rod can be whittled to shape from a stick 18 inches long. Attach a cleat to one end for securing the line. If desired, a leg from an old chair may be used as a jigging rod. Purchase the spoon ready-made, or cast it from block tin.

Through Ice

by Dad Williams

"Tip-ups" need not be fancy. One made from a length of sapling will serve admirably.

This efficient mechanical ice fishing device is easy to make. It is merely an umbrella rib supported in a notched board driven in ice. A bullet slug, drilled through center, serves as a counter-balance. Below—"Tip-up" made from saplings.



This "tip-up" is one of the simplest to make and most effective. It is merely a length of plywood drilled to receive a broomstick. The line is attached to a peg on one end and the tell-tale flag to the other. Left—A carpenter's chisel, inserted in a length of pipe, provides an excellent tool for chopping through ice.

freeze fast to the ice, preventing the "tip-up" from pivoting unless the lashing is on the loose side. Indians merely tie the line to the tip of a strong, supple branch, shove the butt in the snow and slush alongside the hole to freeze fast.

The better manufactured "tip-ups" have some sort of spool for the line, so the hooked fish is able to run off with the bait unaware it is fast to anything.

Jigging is a more recent method of fishing. The spoon may be purchased in brass, copper or nickel finish, or homemade from block tin molded roughly to the shape of an egg, sliced in half lengthways, a gang hook cast into the smaller end and a hole bored in the other for the line. An 18-inch stick serves as a pole. For this, either a length of hardwood, with a cleated line holder fastened to its butt, or the leg from a discarded chair, with a short length of rung left attached for the same purpose, may be used. "Jigging" is done through a hole in the ice with or without baiting the hook. After ascertaining the depth of the water, the line is adjusted to keep the spoon 8 inches off the bottom. From there it is raised another foot, with a jerking motion of the wrist and forearm, to allow it to descend with the spoon fluttering so as to attract the fish. As fish will respond to the upward jerk as well as to the downward flutter, the fisherman must be ever alert to strike the hook.

Cisco and smelt fishing is carried on in small board or canvas covered shanties, usually as a commercial proposition. In Maine these smelt village shelters are warmed by oil heaters and lighted by lanterns, as much of the fishing is done after dark; spreaders with three or four hooks attached are used. Cisco fishing, as carried out in Lake Geneva, Wisconsin, ice fishing colonies, employs the technique of "plunking" or "tweaking" a bead or minnow baited line through a hole in the ice.

Others often choose to fish with a regular rod and summer lures. Finding, playing and bringing the fish successfully through the small hole in the ice demands skill and utmost care.

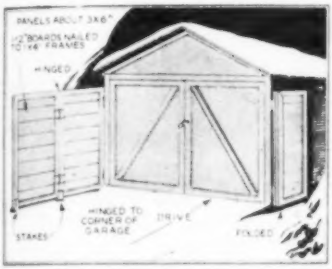
Either minnows or worms are required for effective "tip-up" fishing. Even in coldest weather earth worms may be found in unfrozen ground beneath a sawdust pile or in a farmer's manure heap. Live minnows or silver shiners are probably best and may be bought at sporting goods stores, near ice fishing locations, or secured from fishermen

[*Continued on page* 134]

Timely Short-Cuts For Motorists

Carburetor "Pickling" Adds Mileage

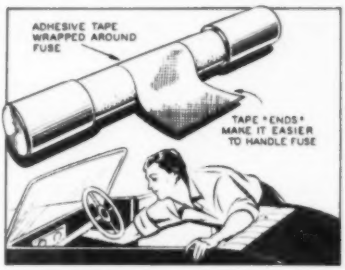
ON CARS which have seen a considerable amount of service there is usually evident excessive fuel consumption troubles. In many cases the carburetor is at fault due to the corrosive film accumulating on the inside metal surfaces. To restore the carburetor to its original condition disassemble, place the parts in a muriatic acid bath for a few minutes, wash in a dilute baking soda and water bath and reassemble.



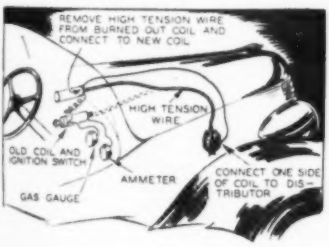
Drift Boards For The Garage Doors

TO KEEP drifting snow from packing against the garage doors construct a pair of folding drift boards from ½-inch stock. Each of the hinged panels should be about 6 feet high and from 3 to 4 feet wide. Mount the boards to the sides of the garage on heavy hinges. Drive stakes in the ground to hold them open during bad weather. The drift boards need not be taken down in Spring as their construction permits them to be folded flat against garage when not in use.—Everett Van Horn.

Tape Tabs Aid In Removing Fuses

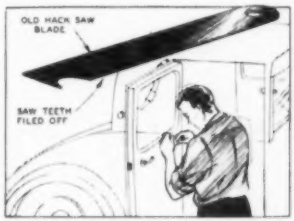


THE fuses used in automotive wiring are in nearly every instance mounted in some out of the way location where they are difficult to get at. To avoid scratched fingers when replacing a burned-out fuse in the future, attach a strip of tape around the glass tubing to form a small tab. Either medicinal or electrician's tape can be used. The protruding tab provides a firm grip for the fingers and at the same time aids in locating the faulty fuse cartridge.—H. Waychoff.


REMOVE HIGH TENSION WIRE FROM BURNED OUT COIL AND CONNECT TO NEW COIL
HIGH TENSION WIRE
OLD COIL AND IGNITION SWITCH
AMMETER
GAS GAUGE
CONNECT ONE SIDE OF COIL TO DISTRIBUTOR

Replacing Switch Type Spark Coils

WHEN the ignition coil of the type that combines an ignition lock burns out it can be replaced with an ordinary type without affecting the operation of the switch. Remove the high tension wire from old coil and place it on new. Connect one side of new coil to terminal of old where gasoline gauge is connected and wire other side of new coil to distributor.

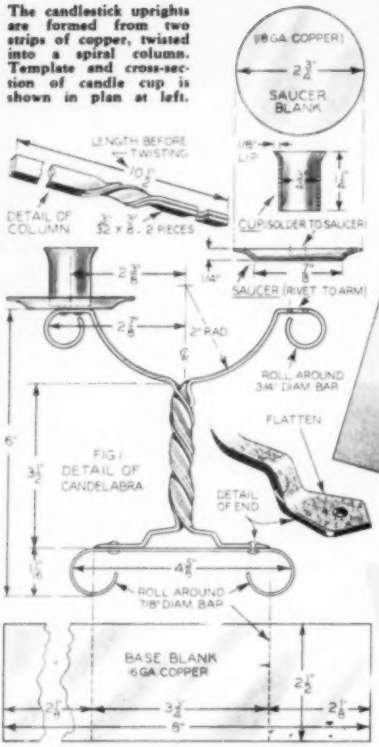


Hack Saw Blade Forms Door Handle Tool

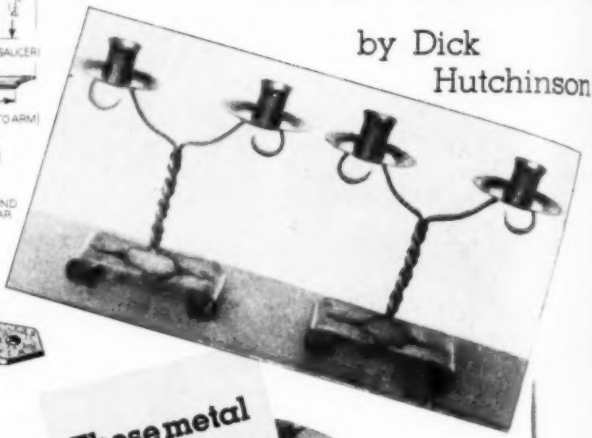
A HACK saw blade ground down to form a hook like the one shown in the accompanying illustration makes a useful tool for removing certain types of window cranks which are secured with a small spring clip.—Wilkie Walter.

HAMMERED FOR HOME

by Dick Hutchinson

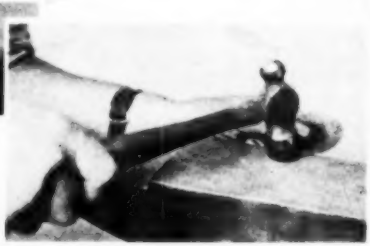


The candlestick uprights are formed from two strips of copper, twisted into a spiral column. Template and cross-section of candle cup is shown in plan at left.



These metal craft creations are not only novel but useful.

The candle cup is hammered to shape over the tip of the anvil, as illustrated in this scene.



Place the upright strips in the vise and twist them to shape by grasping them in the jaws of a wrench. Left—Hammer the saucers to shape with a ball pein hammer.

PRODUCING metal articles in the home workshop does not involve the use of expensive bending machines or other costly equipment. The candlesticks, ash tray and picture frame described here are not only easy to make but provide the craftsman with something that he can show his friends with a feeling of satisfaction. Tin snips, ball pein and planishing hammers and an anvil are all you will need in the way of tools.

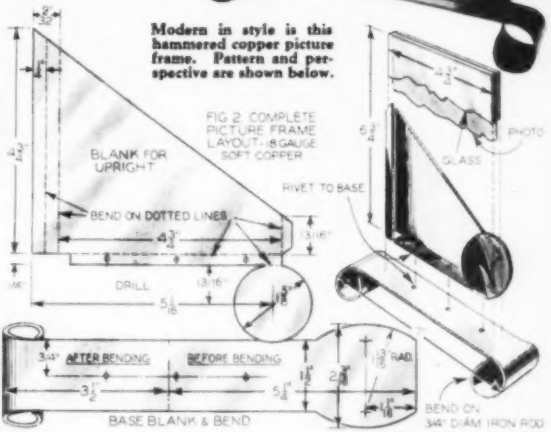
In making metal candlesticks the craftsman is usually at a loss as to how to form the cups. Also, it is almost impossible to produce an attractive column for a tall candle holder. In the production of the pair of candelabra illustrated here both of these obstacles have been overcome very beautifully.

The column for each piece is of $\frac{3}{32}$-inch sheet copper, $\frac{3}{8}$-inch wide by $10\frac{1}{2}$ inches long. The edges are filed smooth and the pieces hammered. Place two pieces together with the ends even, and set down in the vise 2 inches and clamp. Then, grasp them with a small monkey wrench and twist into a spiral as is illustrated, making it about 3 inches long. The spiral, when twisted tight,

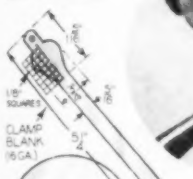
COPPER WARE CRAFTSMEN

Ash trays like this one are easy to make. A spring clip holds them securely to the edge of table. The clip may be twisted to form a handle when using the trays in the conventional manner.

Modern in style is this hammered copper picture frame. Pattern and perspective are shown below.



Right — Shaping bowl on anvil with ball pein hammer.



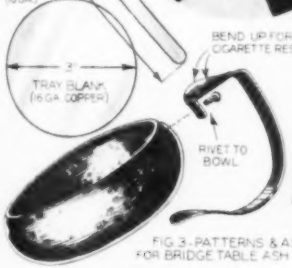


FIG. 3-PATTERNS & ASSEMBLY FOR BRIDGE TABLE ASH RECEIVER

The metal frame is bent in the vise between hardwood blocks, as illustrated in the photographs below.

Rivet the combination clip and cigarette holder loosely to tray with a No. 14 brass escutcheon pin.

will hold together evenly, making a very attractive column.

Bend the two lower ends to shape, and spread out flat with the planishing hammer, drill holes for riveting to base, then bend the other ends out and shape as shown. Drill two holes in each for riveting to candle saucers.

The base is of 16-gauge sheet copper, 2½ inches wide by 8 inches long, hammered and the ends are rolled under. This is done by rolling them around

[*Continued on page* 130]

Clothes Pin Removes Bulb

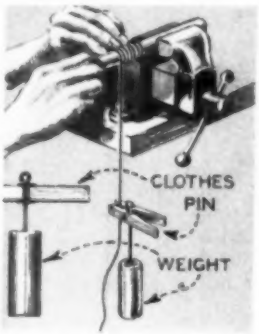
MANY times a broken bulb is difficult to remove from its socket without danger of cut fingers or shocks. A straight clothes pin makes a good tool for removing these broken bulbs without the usual dangers. Slip the prongs over the glass stem, with the tips down into the cavity. The base usually will turn easily.

Bend Improves Plug Contact

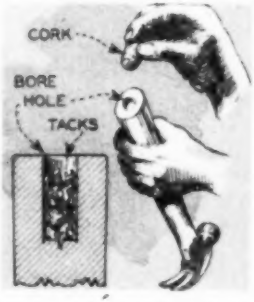
WHEN the contacts of any electrical appliance become worn either by wear or arcing, they may be improved by making a slight bow in the center of one of the terminals. This method is useful on all appliances having the flat type of contact.

Weight Aids Coil Winding

A WEIGHT capable of maintaining tension on the wire will be found to be a great help in coil winding. A spring type clothes pin as shown in the drawing will be found satisfactory for attaching the weight to the wire. It should weigh approximately two pounds for best results, and can be made by pouring cement or lead in a short length of gas pipe. In use, the coil form is held in the jaws of a vise. After the coil is started, the extra wire is dropped to the floor and the weighted clothes pin is clamped to the wire just high enough to be above the floor. As the wire is used, the weight may be slid down. In this way, a uniform tension is maintained, resulting in a more even winding. Also, the use of this device permits the operator to have both hands free for the actual winding operation.



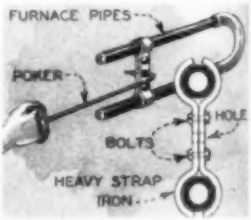
Hammer Handle Holds Tacks



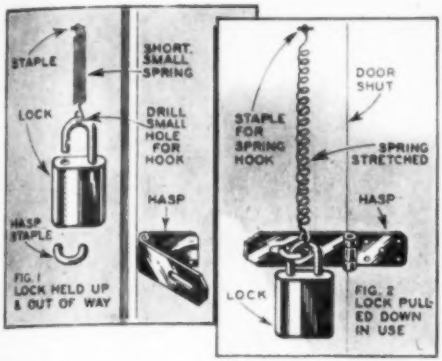
ANYONE who has occasion to use several small tacks at a time will find the idea illustrated at the right very useful. A small hole is drilled in the handle of the hammer to be used for driving the tacks. The holes can be two or three inches deep. Close the opening with a small cork, and the hammer never need be without tacks. The depth of the hole will control the amount of available space for holding the tacks or small nails.

Soot Scraper Aids Furnace

WHEN the water heating pipes inside a furnace become coated with soot they lose a considerable amount of their heating efficiency because the layer of soot acts as a heat insulator. An efficient and easy means of keeping these pipes free from soot is to attach a scraper to them as shown in the drawing. This scraper consists of two iron straps shaped to conform to the pipe walls, and bolted together between the pipes. A hole in the center is provided so that a poker can be inserted to move the scraper back and forth over the pipes. This action will remove the deposit in a few minutes.

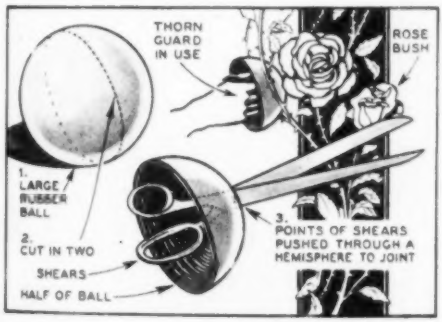


Spring Prevents Lock Loss



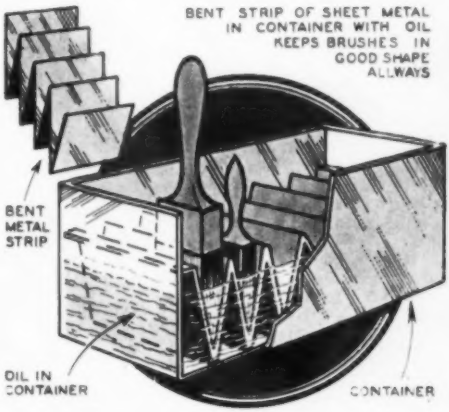
THE spring hanger shown in the drawing is a simple way to keep a padlock where it can be found at all times, while it does not interfere with locking the door. Drill a small hole the diameter of the spring wire, through the hook of the lock. Insert the end of the wire and bend it so that it will not slip out. Then fasten the spring, with the lock hanging, far enough above the hasp to keep it out of the way when the door is open, but not far enough to prevent it from being pulled down into place when it is needed.

Rubber Ball Guards Hands


THORN GUARD IN USE
ROSE BUSH
1. LARGE RUBBER BALL
2. CUT IN TWO
SHEARS
HALF OF BALL
3. POINTS OF SHEARS PUSHED THROUGH A HEMISPHERE TO JOINT

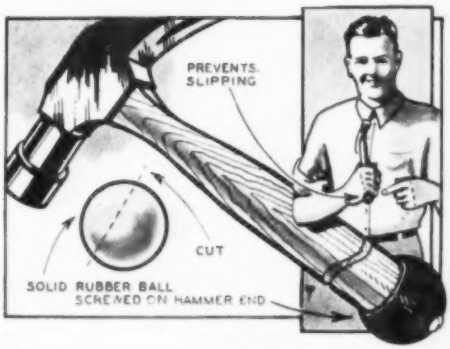
MANY times sharp thorns on rose bushes seriously interfere with the cutting of the flowers, and occasionally painful scratches are the result. By fastening half of a hollow rubber ball over the shears, this difficulty is removed. Use a ball large enough to cover the hand but not so large that it becomes difficult to push it through the bush. After the ball is cut in half, make a small hole where the points of the shears are to pass through. Push the ball over the ends of the blades up to the point where they are fastened together. If the ball is placed either side of the junction, the shears will be hard to open.

Bent Metal Holds Brushes


BENT STRIP OF SHEET METAL IN CONTAINER WITH OIL KEEPS BRUSHES IN GOOD SHAPE ALLWAYS
BENT METAL STRIP
OIL IN CONTAINER
CONTAINER

PAINT brushes not in use can be kept in good condition by placing them in a container such as shown in the drawing. The size of the box and the number of folds in the metal will regulate the number of brushes it will hold. The metal need not be of heavy gauge—just heavy enough to maintain the position of the brushes. When the metal is selected, be sure that it is not too wide to permit the oil to flow freely around the brushes.

Ball Prevents Hammer Slips



BY FASTENING one-half of a solid rubber ball to the end of a hammer handle, danger of the hammer slipping out of the hand is eliminated.

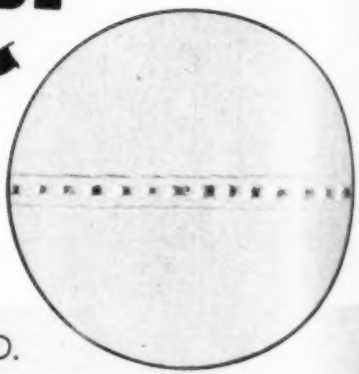
MICROSCOPE DISCLOSES REAL

FINGERPRINTS IN FUR

INCREDIBLE, but indeed true, the hair of no two of all the thousands of different species of mammals is exactly alike. Amazing, too, that the microscope is an important tool in this great industry as it is in so many others; the limitless powers of this unique instrument seem capable of invading every field. A journey via your microscope into the mysterious domain of fur is certain to prove fascinating.

Examination of hairs under a microscope is a meticulous business, and yet the technique is very simple. Hairs as obtained from the body or from pelts are dirty and greasy and must be thoroughly cleaned in order to reveal their minute structure which, like the fingerprints of the human hand, affords a positive means of identification. The solution for cleansing is a mixture of equal parts of 95 per cent alcohol and ether. As ether is explosive, keep it away from all flames! Hold one or a few hairs with a pair of fine forceps and wash them back and forth slowly in the fluid for a few minutes.

The hairs are next dried over an electric bulb, and are then placed on a scrupulously cleaned slide and capped with a cover glass for temporary inspection under the microscope, without any mounting medium. Any dust or dirt interferes seriously with determination of the exceedingly fine scales which clothe the exterior of the shaft. If any dust or grease remains on the hair, repeat the cleaning, drying and



This photomicrograph of a beaver fur hair illustrates a simple medulla of the discontinuous ovate type. Cuticular scales may be seen at the edges.

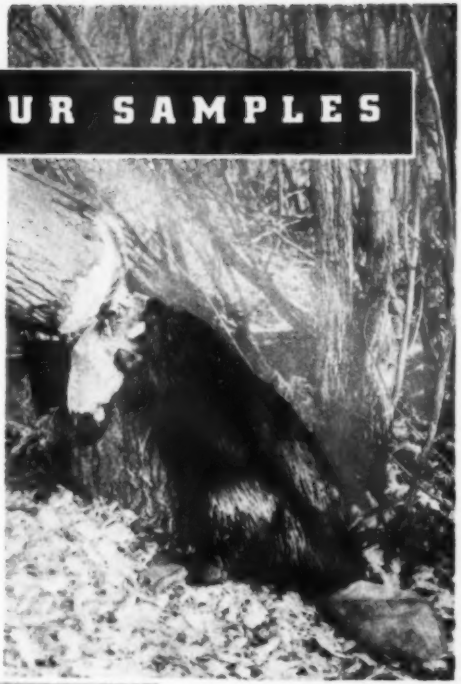
by Julian D. Corrington, Ph. D.

IDENTITY OF FUR SAMPLES

inspection, mounting perfect specimens in balsam.

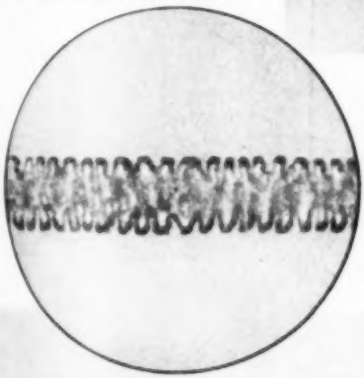
Staining helps bring out the cuticular scales, the best reagent being a saturated solution of safranin in 95 per cent alcohol. This means the maximum quantity of the dry powder that can be dissolved by a given amount of the alcohol. Immerse a hair in this stain for two minutes, then dry as before and mount in thick balsam. Don't use thin balsam as the stain will run and spread. Hairs are commonly mounted unstained, however, so this procedure may be omitted if desired.

Specimens are not at all difficult to collect. Provide yourself with a number of gelatin capsules, preferably the kind that veterinarians use in putting up horse medicines, and ransack first the various fur pieces belonging to feminine members of the household such as coats, neckpieces, trimmings and gloves. It will do these garments no harm at all to remove the three or four hairs that are needed. In pelts like mink and fox, collect both the over and under fur hairs, which can be mounted together under the same cover glass. The typical structure in each case is to be found about one-third of the distance outward from base to tip of the entire hair, and this is the portion to put in your capsules for mounting. Of course the outer two-thirds or more in many garment furs will already have been removed by clipping, as in Hudson seal, which is trimmed and dyed muskrat, while some hairs even when complete are so short that their entire length will go under a cover glass, so these factors have to be taken into account in collecting material.



The fur of the beaver is only one of the many types that is well adapted for examination and study under microscope.

The protective hair from a mink pelt is shown in the photomicrograph below. It illustrates a simple medulla of the continuous nodose variety as it appears when viewed through microscope. Right—Before mounting on slides, hairs are cleaned in alcohol and ether bath.

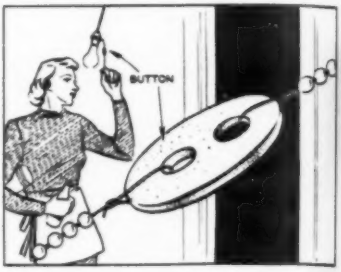


Then come the domestic pets, as cat, rabbit and dog; the farm animals and occasional opportunities offered by unusual captures or pets, and perhaps some friend connected with a zoo or museum can be enlisted in this enterprise. Finally there is the fur store and commercial supply house as sources for the larger slide collections. Pay particular attention to keep hairs from different sources in separate capsules so

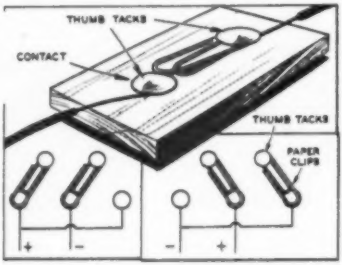
[*Continued on page* 122]

Electrical Kinks For Shop And Home

Button Insulates Socket Pull-Chain



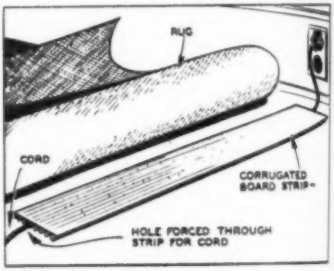
OFTENTIMES a portion of an electric lamp socket will develop a short circuit on the insulated side of the line. Accidentally pulling the chain while holding the other hand on a water faucet or standing on a damp basement floor will result in a noticeable shock. To avoid this danger, cut the pull-chain and insert a small bone button to serve as an insulator. Use fine wire or thread for attaching button to cord.—A. Tempe.



Paper Clips Form Handy Switches

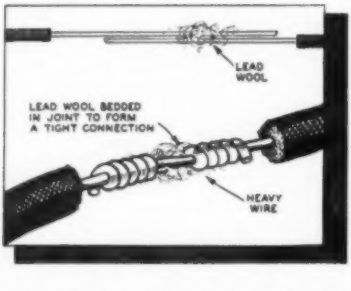
A FEW thumbtacks and paper clips provide the necessary essentials for making inexpensive push and throw switches for use in low voltage electrical experiments. Spring each paper clip slightly and attach it to a block of wood with a thumbtack. Another tack mounted about 1¼ inches from the other serves as the contact. Illustrated are two simple switches. The combinations are unlimited. — H. W.

Cardboard Electric Cord Rug Bridge



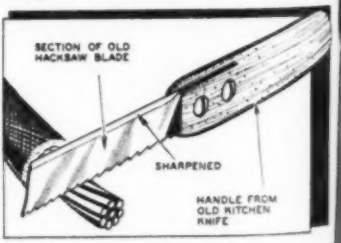
TO KEEP electric cords, which run under carpets, from pulling out of place or breaking down the nap of the fabric, run them under a cardboard bridge. Cut a strip of corrugated packing carton about 3 inches wide and the length of the rug, passing the cord between one of the corrugations. Several pieces of cardboard can be fastened together with gummed tape if necessary.—V. H.

Plumbers' Wool Makes Tight Splices



WHERE electric wires cannot be satisfactorily spliced with a soldered joint, plumbers' wool can be used to insure a good contact. Wrap a small wad of the wool around the stripped wires before forming the joint. The resulting splice, if made as shown, will not only be neat, but provide the lasting conductivity of a soldered connection. — A. H. Waychoff.

Hack Saw Blade Insulation Scraper

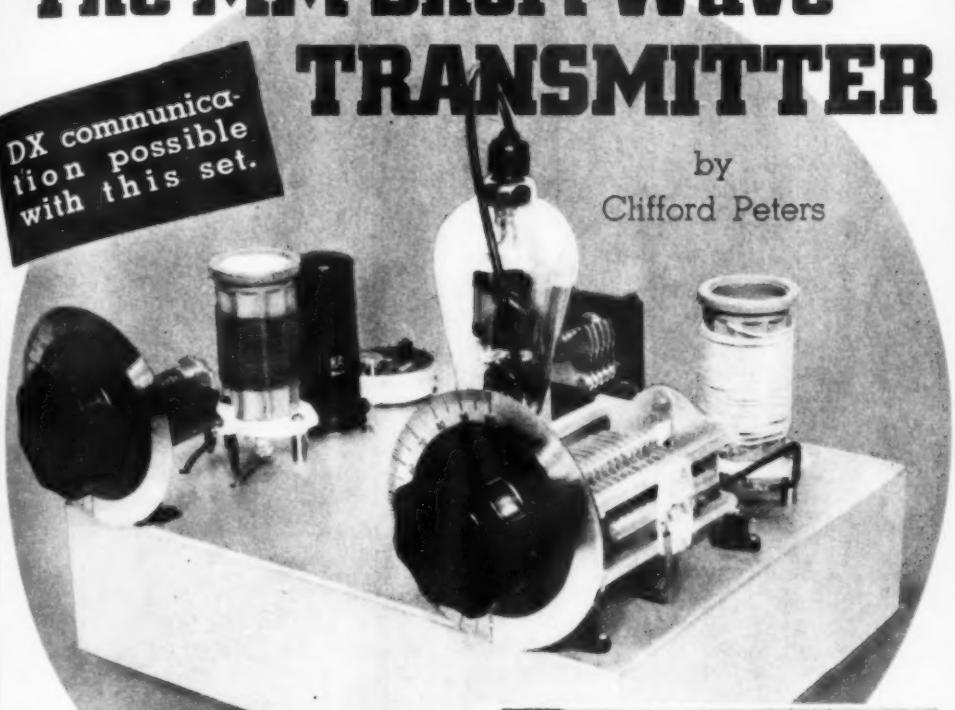


A BROKEN hack saw blade attached to a wooden handle and ground down on one side to a knife edge serves as a handy tool for stripping insulation from heavy stranded wire. Toothed side is used for scraping.—A. H.

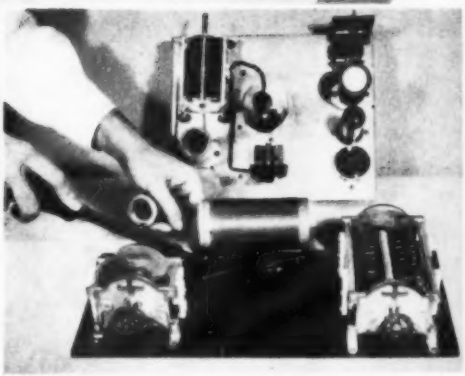
The MM Short-Wave TRANSMITTER

DX communication possible with this set.

by Clifford Peters



The completed transmitter. The oscillator is on the left side of the chassis and the amplifier at the right. The neutralizing condenser is mounted behind the T55

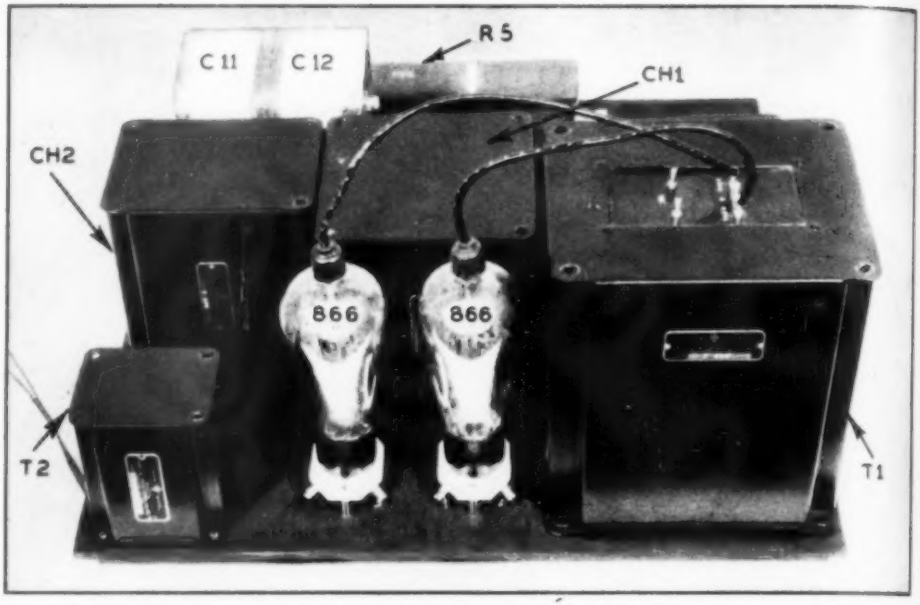


The antenna coupling unit is shown in the foreground. Condenser at right is connected into the circuit when antenna feeder arrangement requires it.

THE amateur about to go on the air for the first time, or the old timer who took down his antenna when the U. S. entered the war and put it up again after the Armistice, have one thing in common: both want to get as much out of their rigs as possible. Also both want to be able to increase power with a minimum of additional expense.

For the beginner, this transmitter offers a simple and inexpensive means for getting on the air with low power—using only the 6L6 oscillator—or with medium power—using the 6L6 to excite a T55 output tube. Designed principally as an exciter unit for a T-125 amplifier, to be described in an early issue, this rig can put a healthy sock in any "sky wire."

Many times the inexperienced builder gives considerable thought to the selection of parts for the r.f. section (transmitter proper), but uses the first thing that comes along for a power supply. This procedure is fatal to satisfactory transmitter operation. Usually it is a shock to the builder when he finds that 1,200 volts thought to be supplied to the plate of the final actually is but 1,000. Filament transformers which do not supply the correct



The amplifier power supply. T1, the plate transformer, is at the right. T2 furnishes power for the 866 filaments. The filament transformer for the T55 is not shown, as it is mounted near the rear of the r.f. chassis. The swinging choke is behind the 866's. The bleeder, R5, is shown at the rear.

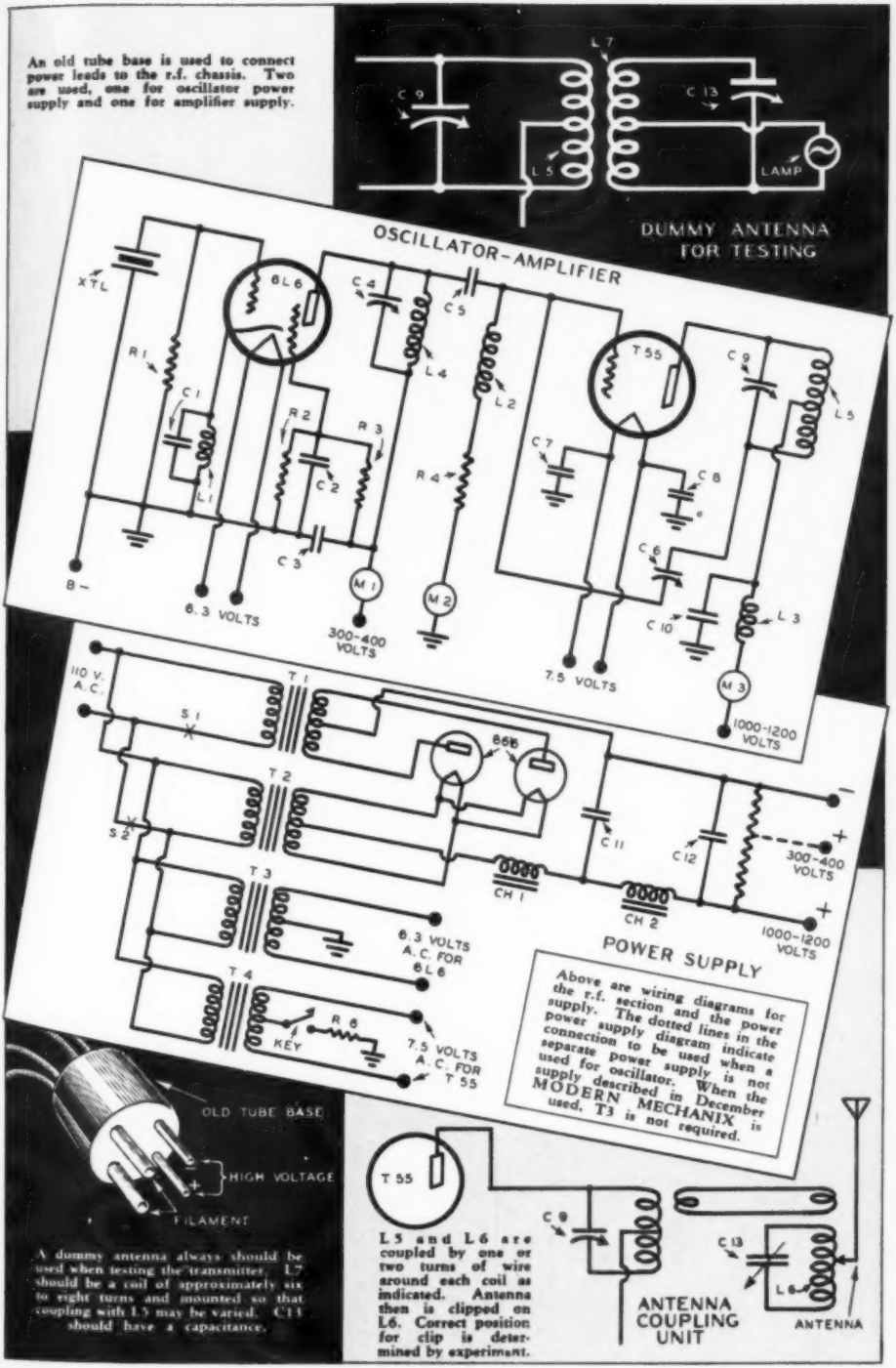
voltage greatly shorten tube life. Saturated chokes have no filtering value, and they, therefore, might just as well not be in the circuit. The point to be remembered is: Use a power supply capable of delivering its rated output.

While emphasis is placed on the selection of power supply equipment because this part of the transmitter many times is overlooked, r.f. section components should be selected just as carefully. Nothing is more disturbing than having individual parts break down during use.

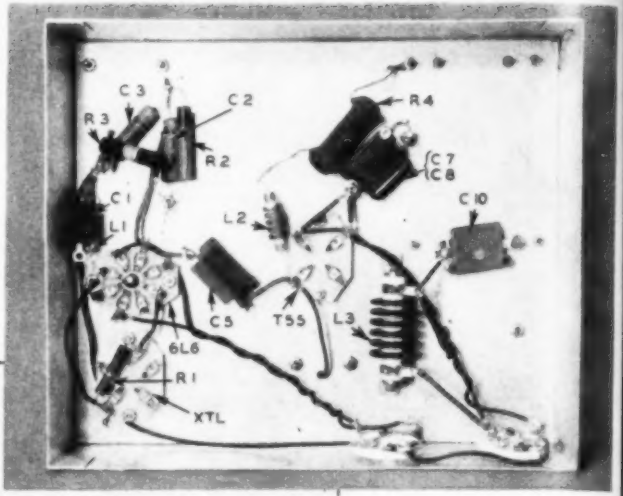
The experienced amateur knows, but the

Parts Required

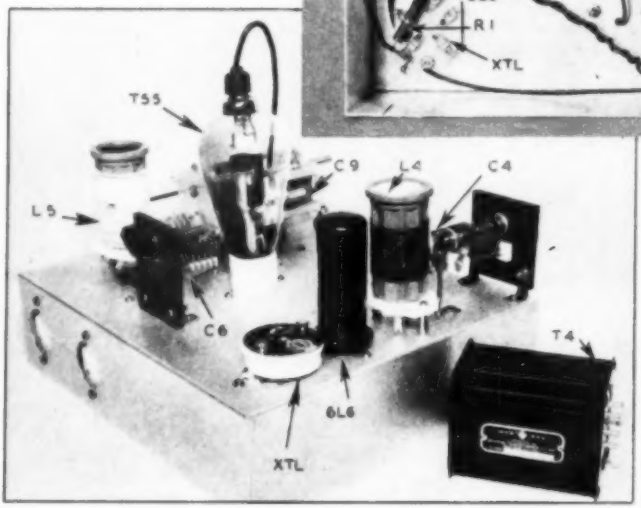
R1 100,000 ohms 1-watt (IRC BT-1)
R2 35,000 ohms 2-watt (IRC BT-2)
R3 10,000 ohms 10-watt (IRC DG)
R4 5,000 ohms 10-watt (IRC DG)
R5 60,000 ohms 200-watt (IRC HOA)
R6 400 ohms 10-watt (IRC DG)
C1 .00015 mf. (Cornell Dubilier 4-6T15)
C2 .01 mf. (Cornell Dubilier DT-10S1)
C3 .01 mf. (Cornell Dubilier DT-10S1)
C4 .00014 mf. Hammarlund MC-140-M)
C5 .00025 mf. (Cornell Dubilier 4-25T25)
C6 .000020 mf. (Hammarlund MC-20-MX)
C7 .006 mf. (Cornell Dubilier 4-12D6)
C8 .006 mf. (Cornell Dubilier 4-12D6)
C9 .00015 mf. (Hammarlund MTC-150-B)
C10 .002 mf. (Cornell Dubilier 4-22020)
C11 2 mf. 2000-volt
C12 2 mf. 2000-volt
C13 .00035 mf. (Hammarlund TC-350-C)
M1 0-100 milliampere meter
M2 0-50 milliampere meter
M3 0-200 milliampere meter
L1 2.5 mh. choke (Hammarlund CH-X)
L2 2.5 mh. choke (Hammarlund CH-X)
L13 500 milliampere choke (Hammarlund CH-500)
T1 1460-0-1460 (Kenyon T-666)
T2 2.5 volt 10-ampere (Kenyon T-360)
T3 6.3 volt 3-ampere center tap (Kenyon T-351)
T4 7.5 volt 4-ampere center tap (Kenyon T-353)
Ch1 5-18 Henry swinging choke (Kenyon T-513
Ch2 10 Henry filter choke (Kenyon T-176)
1 Taylor T55 tube
2 Taylor 866 tubes
1 Ratheon 83 tube
1 Ratheon 6L6 tube
Xtl holder (ICA No. 414)
3 grid caps (ICA No. 870)
Insulating rods (ICA No. 2175)
Fuse mounts (2) (ICA No. 2342)
Terminal strip (ICA No. 2413, No. 2420)
3 dials (ICA No. 2169)
Standoff insulators (ICA No. 2300)
Insulex standoff insulators (ICA No. 2338)
8 four-prong sockets (Hammarlund S-4)
1 five-prong socket (Hammarlund S-5)
1 eight-prong socket (Hammarlund S-8)
four-prong coil forms (Hammarlund SWF-4)
5 flexible couplings (Hammarlund FC)
S1, S2 (ICA No. 1230)
1 metal chassis 10x12x3 (ICA No. 1515)
2 standoff insulators with jacks (ICA No. 2304)
2 transmitting plugs (ICA No. 403)
Bakelite tubing 6"x2½" (ICA)
Miscellaneous wire, bolts, nuts, washers, screws, etc.
2 four-prong tube bases
1 or more crystals


An old tube base is used to connect power leads to the r.f. chassis. Two are used, one for oscillator power supply and one for amplifier supply.
L7
C 9
C 13
L 5
LAMP
DUMMY ANTENNA FOR TESTING
OSCILLATOR-AMPLIFIER
XTL
6L6
C 4
C 5
R 1
C 1
L 4
L 2
T 55
C 9
L 5
R 2
R 3
C 7
C 8
L 1
C 2
R 4
C 6
C 3
M 1
M 2
C 10
L 3
B –
6.3 VOLTS
300-400 VOLTS
7.5 VOLTS
M 3
1000-1200 VOLTS
110 V. A.C.
T 1
S 1
866
T 2
S 2
C 11
C 12
300-400 VOLTS
T 3
CH 1
CH 2
6.3 VOLTS A.C. FOR 6L6
1000-1200 VOLTS
T 4
R 6
KEY
7.5 VOLTS A.C. FOR T 55
POWER SUPPLY
Above are wiring diagrams for the r.f. section and the power supply. The dotted lines in the power supply diagram indicate connection to be used when a separate power supply is not used for oscillator. When the supply described in December MODERN MECHANIX is used, T3 is not required.
OLD TUBE BASE
HIGH VOLTAGE
FILAMENT
A dummy antenna always should be used when testing the transmitter. L7 should be a coil of approximately six to eight turns and mounted so that coupling with L5 may be varied. C13 should have a capacitance.
T 55
C 9
C 13
L 6
ANTENNA COUPLING UNIT
ANTENNA
L5 and L6 are coupled by one or two turns of wire around each coil as indicated. Antenna then is clipped on L6. Correct position for clip is determined by experiment.

Right—Under view of the r.f. chassis. C3 is the coupling condenser between the oscillator and the amplifier. Slightly larger or smaller capacity than the one recommended may be found more suitable after experiment. A five-prong socket shown at lower left is used for the crystal holder.



Below—A rear view of the r.f. section. T4, shown at the right, should be mounted near enough to the chassis so that filament leads are as short as possible. Connections from the power supplies are made to the sockets shown at the left corner of the chassis.



newcomer many times overlooks the fact that a transmitter is far more demanding on its parts than a receiver. Lucky indeed is the "ham" who has not lost a pair of rectifier tubes, a choke or a transformer, when a filter condenser "shorted."

Assuming that the builder has obtained all the parts, the next step is the laying out of the transmitter. While the experienced "ham" probably will have his own ideas as to changes he would like to make, the newcomer will do well to follow the one shown. To anyone contemplating changes we make but one statement: this layout *works*!

Although wood could have been used, the metal chassis was selected because of its shielding properties and snappy appearance. Drilling metal is of course a little more troublesome than drilling wood, but if sharp drills are available, the additional effort will be negligible. The set was wired throughout with No. 14 rubber covered wire. Where leads are brought through the chassis, the hole should be considerably larger than the wire to minimize possibility of arcing over. An even better method is to use feed-through insulators.

Probably the most troublesome holes to make are those for the sockets. With a saw drill this operation is simple. If this tool is not available, a series of small holes should be drilled around a circle, and with the help of a chisel to break the metal between the holes, the job becomes much easier than appears at first glance.

Two sockets were mounted vertically at the rear instead of binding posts. Two old tube bases are cleaned of class and wires, and are attached permanently to the leads from the power supply. Connecting and disconnecting the set from the power supply then becomes a simple matter.

The metal type 6L6 was selected because the oscillator was intended for fundamental frequency operation only. The T55 can be used as a doubler and still give plenty of output. Inasmuch as a T125 is to be used as a final amplifier, and the T55 will give more than enough excitation even when doubling, the oscillator was kept in the simpler form.

[*Continued on page* 142]

MODERN MECHANIX
PHOTOGRAPHY
SECTION

PAGES 103 116

1ST PRIZE

FIRST PRIZE—$15—goes to Fern Franco, of Hiawatha, Kan., for "The Singing Lesson", an unusual baby picture. Taken with a Rose reflex camera, 1/25 second at f. 6.3 on supersensitive pan film. North window at child's right, and two photofloods in reflector at left. SECOND PRIZE—$10—to Stephen F. Herris, of Dover, Mass., for "A Dog's Life". A lot of patient waiting by the photographer and an exposure of 1/000 second with a Graflex caught this prodigious yawn! Taken in bright sunshine at f.8 on Verichrome film, developed in D-76. Background is piece of black velvet pinned to wall to emphasize the dog's light coloring. FOURTH PRIZE—$5—to Franklin Davis, of Ocilla, Ga., for this difficult shot of a spider in its web. Made at night with a small flashbulb in hand reflector, f.11 on Panatomic film, shutter held open at "B" while flash was set off. Eastman 5x7 camera. A flashlight was used to illuminate the spider while the camera was being focused.

4TH PRIZE

2ND PRIZE

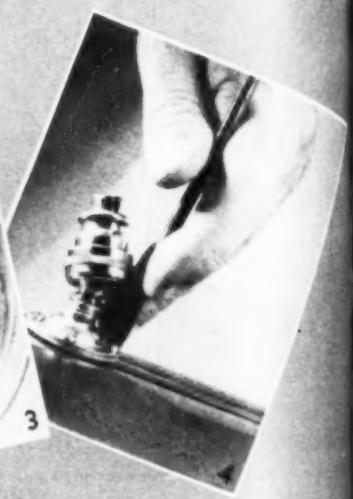
5TH PRIZE

3RD PRIZE

THIRD PRIZE—$5—to John Steiner, Chicago, Ill. Exposure made by putting dish of flash powder on stick and touching it off in the camp fire. Speed Graphic camera, f. 4.5 opening. FIFTH PRIZE—$5—to Grant Russell, St. Louis, Mo., for this well-composed scene of two camera fans out for a day in the country. Zeiss Maximar, 1/50 sec. at f.8, with K-1 filter, Panatomic film.

MONEY FOR YOUR PICTURES

Get busy with your camera and send in unusual pictures of people, animals, machines, trains, airplanes, etc. Each month we will pay $15 for the best picture received from readers, $10 for the second choice, and $5 each for the next three selections. Prints should be glossy, as large as possible up to 8x10 inches (although a small, clear photo is more desirable than a big, fuzzy one) and should be accompanied by the following data: make and size of camera, type of film, and how developed and printed, lens opening and shutter speed, and lighting conditions. Wrap all prints carefully and include postage if you want them returned. Address all contributions to Photography Editor, MODERN MECHANIX, 1501 Broadway, New York, N. Y.



IF YOU want to achieve the latest and most modern effects with your indoor photography this winter, you will find a good spotlight almost a necessity. This one is entirely up-to-date both as regards performance and appearance. With it you can make sparkling photographs with brilliant highlights and rich, black shadows that stand out amazingly from the usual run of medium-tone, gray pictures.

Interesting, too, is the appearance of the finished lamp; you will agree that in design and finish it has all that could be asked for in a factory-made article, yet all of the parts are common and inexpensive. Exclusive of the lens, you can build this spotlight for less than a dollar, using new parts. The lens will probably cost several dollars more.

The first stop will be at the hardware store, for a 12-inch length of 6-inch stovepipe. This should be cut from the uncrimped end. You will also need an 8-inch piece of ⅛-inch brass pipe, threaded at both ends to take a keyless socket and ornamental brass loop which you can get at an electrical supply store. In addition to a friction swivel and various small parts, most of which you can retrieve from the junk box, you will need two automobile hub caps of about a 6-inch diameter. The kind shown in the illustrations are for a popular make of automobile; they fit snugly into the ends of the stove pipe, and being heavy and chromium plated, they make a fine appearance as part of the completely finished spotlight.

Most of the constructional and assembly

Constructed of simple and easily secured parts, the photo spotlight shown at top will help you to obtain striking photographic effects through use of shadows and light contrast. Steps in making spotlight are (1) cutting lens hole in auto hub cap with scroll saw; (2) bending lens-holding brackets which are cut from stiff spring steel; (3) attaching lens-holder to rim of hub cap with bolts; (4) bolting the mounting swivel in place on section of stovepipe, 12 inches long, which serves as wall of spotlight.

details are explained by the photographs. Cut a hole in one hub cap for the plano-convex condenser lens, which you can get at a camera supply house. It is a good plan to first consult a local theatre manager, however. Condenser lenses are no longer used on modern high-intensity projectors and can usually be picked up for a small sum. The method of attaching the lens inside the hub cap, as shown in the accompanying photos, will hold it very securely and yet allow for expansion due to heat from the photoflood lamp that is used in the finished spotlight.

The piece of brass pipe serves as a control rod for focusing the lamp and also as a conduit for the rubber-covered lamp cord. It passes through a brass bushing which is bolted over a hole in the center of the other

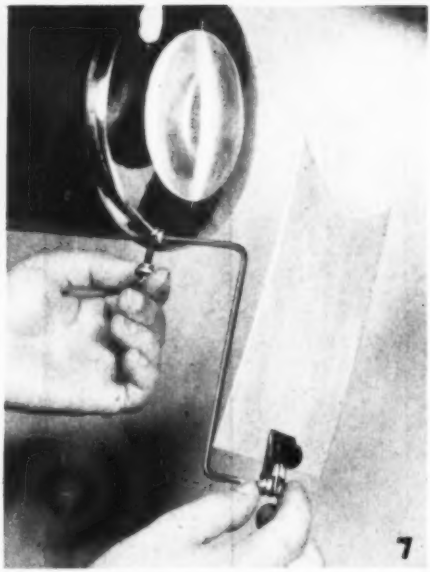
The focusing rod bushing is bolted on the inside of the hub cap (5) and provided with a simple screw clamp outside (6) to permit easy control.

MODERN PHOTO SPOTLIGHT

Economical and easy to build, this spotlight gives excellent performance.

by
Kenneth Murray

As an example of what the home-built spotlight can do to provide light and shadow contrast, study the photo reproduced in circle. ➡



A piece of cardboard held in a paper clamp attached to end of bent curtain rod, which passes through bushing inserted in hub cap (above), serves as a mask that can be used to vary the amount and shape of beam cast by spotlight.

A practical demonstration of the use of the spotlight is shown above. Illumination from the spotlight, behind the subject, touches the hair, shoulder, and hands. General illumination, to show detail in the shadows, was secured by means of an ordinary floodlamp.

hub cap. The bushing should be provided with a screw clamp at the outside so that the control can be held in position once it is focused. When it is withdrawn, removing the photoflood lamp farther from the lens, the light spot will become smaller. Pushing the control all of the way in causes the beam of light to widen until it is almost a flood light, and can in fact be used for that purpose.

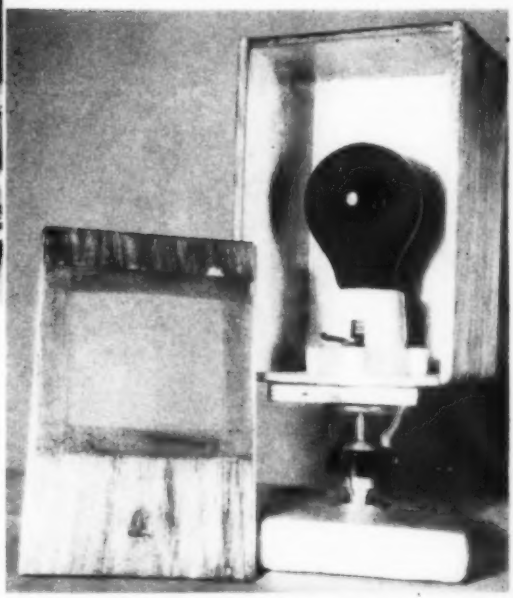
A unique feature of this spotlight is the light control mask shown in photo 7. This consists of a piece of cardboard held in a paper clamp and adjustable so as to be any distance from the lens. The cardboard can be cut with a mask-opening of any shape so as to vary the amount and shape of the light and secure some really novel effects. The paper clamp which holds the mask is attached to the end of a bent 5c sash or curtain rod, which passes inside the outer sleeve of the rod located in holes between front and rear hub caps. The bushing shown in the illustration is merely a brass nut drilled to fit the rod and then soldered over a hole in the front hub cap. The clamping screw, to hold the mask in any position, passes through a threaded hole in the rim of the hub cap itself. For this purpose the 10c taps and dies sold at 5-and-10c stores are very handy.

An ordinary brass swivel was used to mount the spotlight on a metal stand, but you can use any other method, as long as it is possible to tilt the lamp to most any angle. It becomes less effective if the angle is limited, for many of the best effects are secured by throwing the light directly down from above, or directly up from the floor. For utmost flexibility the stand should be adjustable for height. It will be noticed that no provision has been made for ventilation, as it has been found to be unnecessary. The thin stovepipe walls of the lamp radiate the heat quickly.

Getting the best results with your spotlight depends on practice as much as anything else: with a little experience and a few failures to your credit, you will have learned to judge the intensity of the light and the darkness of the shadows it casts, and how to balance these with one or more other lights, of the floodlight type, so that the results are striking. As an example of what can be done with the spotlight and one other light to show detail in the shadows, examine the still-life and portrait studies shown with this article. Although the spotlight effect is somewhat exaggerated in order to provide contrast that will not be lost in reproduction, it gives a hint of the possibilities in this direction.

DARKROOM LAMP Tilts To Any Angle

by Nathan Sperber



An adjustable safelight is especially useful when doing tray development of films, chloride and bromide papers. This light was built around a wooden box such as used for chalk sticks.

THE inability of darkroom lamps to tilt is a serious shortcoming. The need for a tilting device is felt especially in the tray development of films, chloride and bromide papers, where it is necessary to keep a close watch on the formation of the image.

Obtain a chalk box having a cover which slides in a groove. The box and the cover are carefully sand papered, and a hole a ½ inch in diameter is drilled in the bottom center of the back. A porcelain socket is screwed in position as shown by the illustration. A piece of ⅜-inch pine, 3 inches square, is glued to the bottom of the box. A $\frac{3}{16}$-inch hole is drilled in the center of the block. The exterior of the box is stained mahogany or walnut, while the interior is left untouched. Shellac is applied and a 3-foot length of wire is attached to the socket through the hole in the back.

A 3-inch square is cut in the cover 1½ inches from the top and a 3-inch square of ground glass is put in the hole. Cellulose cement is used to secure the glass, and adhesive tape

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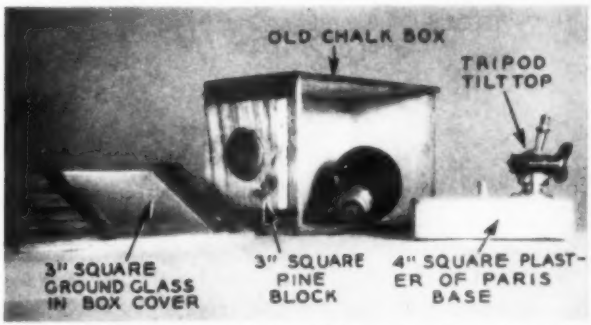
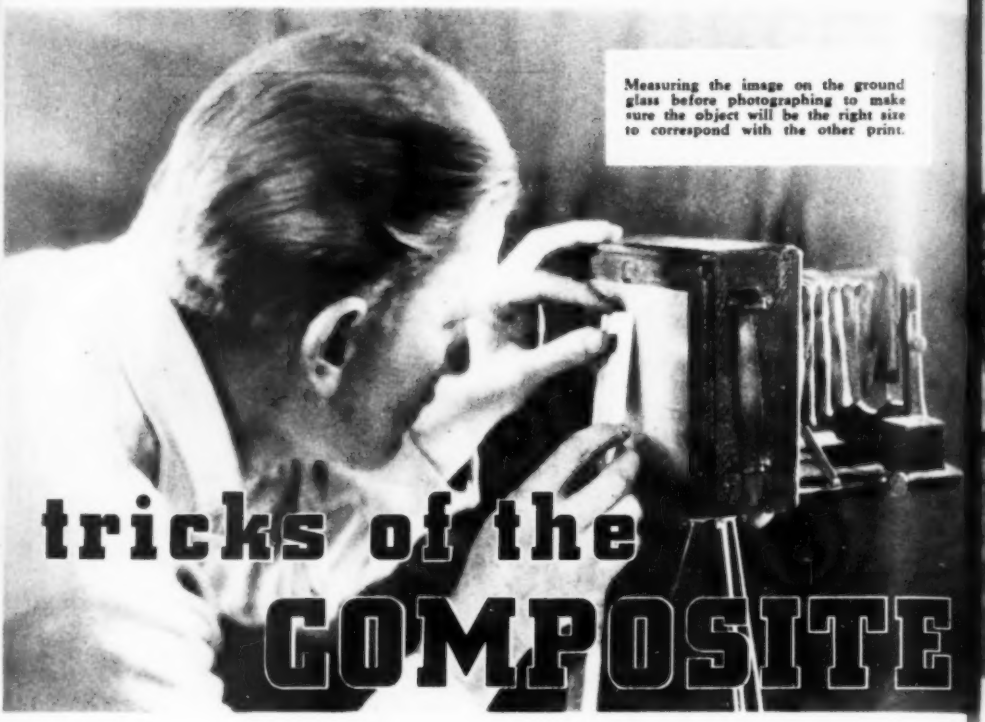


Components of the safelight are shown here. An opening 3 inches square is cut in the chalk box lid, and a piece of ground glass inserted and secured with photographic tape. Inside of box is fitted with a porcelain cleat socket and wired through small hole in rear. Assembled light is mounted to plaster of paris base by means of a tripod tilt-top. Light source is provided by a 7-watt electric ruby dark-room lamp.

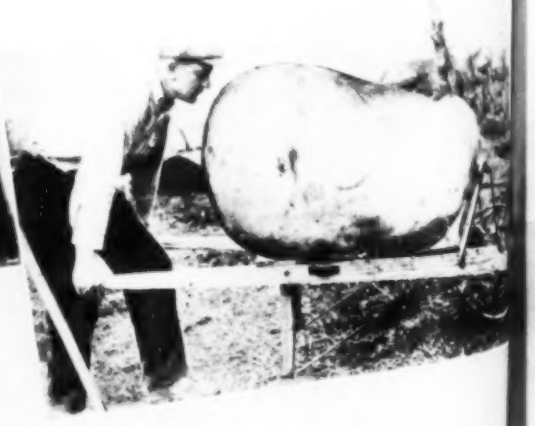


Measuring the image on the ground glass before photographing to make sure the object will be the right size to correspond with the other print.

tricks of the COMPOSITE

by Paul Hadley

THE making of composite, or combination photos, is one of the simplest branches of trick photography, yet is one which the amateur photographer seldom attempts. Easier by far than the double exposure or distorted perspective pictures, the results are more unusual and bizarre, in that parts of any two or more photos



Above: "How's the air up there, big boy?" asks this tiny man of his larger self. Both figures were posed by the same model. Right: "Need for Potato Control!" One tuber like this is a crop all by itself.

This "prehistoric monster" is simply an enlarged photo of a rhinoceros, on which a smaller photo of the hunter was pasted; the combination was then copied through the camera.

PHOTOGRAPH

may be combined to make a freakish result. Professionals often resort to this method in making "photomontages," which are often seen in publications. Probably most of you have seen the novelty photo cards in which, for instance, a wagon is seen creaking under the weight of two giant apples which it is carrying to market, or perhaps an ear of corn being loaded on a flat car with a derrick. Many other variations of this type of picture are to be found, all of which were made by the simple method of combining parts of several prints to make a whole.

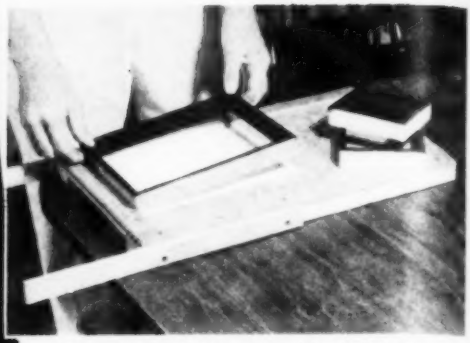
No expensive photographic equipment is necessary in making these pictures. One should, of course, use a camera on which the image can be seen full size on the ground glass before making the exposure, and which has sufficient extension of bellows to allow copies to be made of the combined prints. The larger size plate of film accommodated by the camera, the better, for this gives you a better chance to study the composition of the picture before making it. A copy lens, which can be purchased from any supply house, will enable you to make closeup photos or copies on cameras which do not have the double extension bellows.

The possibilities of composite photos are infinite, and the results you will obtain are limited only by your imagination. The accompanying illustrations show examples of a few of the effects. One shows a modern huntsman armed with a repeating rifle about

[*Continued on page* 126]

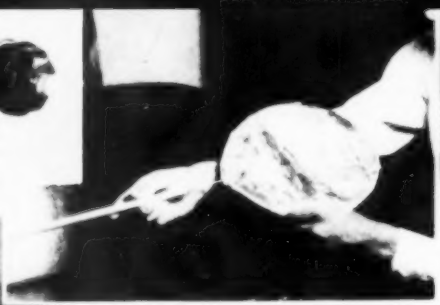
The potato was photographed close up, the print cut out, and then pasted on the photo of the man and the wheelbarrow. Scraping the edge of the potato print with a knife or sandpaper to make it thin allows it to be pasted down without a tell-tale line showing.

Pictures of unusual effect can be made by photographing buildings illuminated with floodlights. This picture of the Nebraska Capitol building shows the striking effect of greater height and contrast which would not be evident if photo were made in daylight. The scene was snapped on a cloudy night on super-pan with camera at f. 4.5 with an exposure of 30 sec. Commercial ortho film with 3-minute exposure is also effective for taking outdoor night photos.



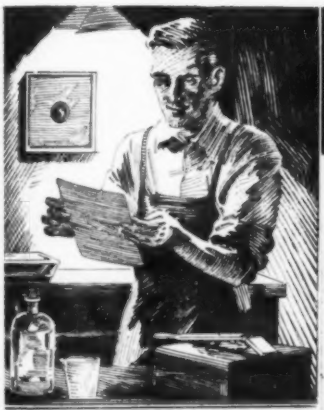
Owners of vertical enlargers often find it difficult to provide their projection prints with neat borders. Simple frames formed from 1 by ¼-inch lattice strips and painted dull black on the inside offer the solution. Placed over the printing paper, they not only serve as masks, but hold the paper flat on the easel of the enlarger.

Camera and Darkroom Kinks



A simple tester for testing flash guns is shown at left. It is merely a 3-volt flashlight bulb inserted in a male attachment plug and wired to prongs. Plug is then inserted in female plug and screwed into flash gun. Center illustration shows a handy reflector made from crinkled foil attached to a wire frame. Its use will provide better contrast on still subjects taken indoors with a time exposure. Use it to reflect light on dark areas. Right—To move a camera without disturbing the tripod a simple tripod truck formed from light stock can be easily built. Ball-bearing furniture casters permit it to be moved without difficulty.

To avoid mixing up black and white "spotting" paints each time a print is retouched, mix up various color tones and deposit on old glass plates from which the gelatin has been removed. File each glass "palette" in a separate film box to protect it against dust. In retouching, select a palette having correct tone and use paint on it to "spot" print. Left—To keep developing solutions at their proper temperature in cold weather, place tank in bucket of warm water.



New ideas and timesavers for the amateur picture-taker and darkroom hobbyist that will add professional touch to his photographic work.

While chemical bottles of uniform shape and size look nice on the darkroom shelf, it is better practice to use containers that are physically different so that their contents can be instantly recognized when working in darkness. Bottles suitable for developing and fixing solutions are shown in photograph at left.

To obtain soft focus effects on "still" subjects, rotate a loose wad of No. 000 steel wool before camera lens. An exposure of 2 or 3 seconds is sufficient for average indoor pictures.

A permanent shelf for supporting 2 or 3 glass funnels is a great timesaver when both developer and hypo are to be filtered at the same time. Space holes so that 2 trays or tanks can be placed side by side. Shelf can be fastened to worktable with a short upright.

HOW

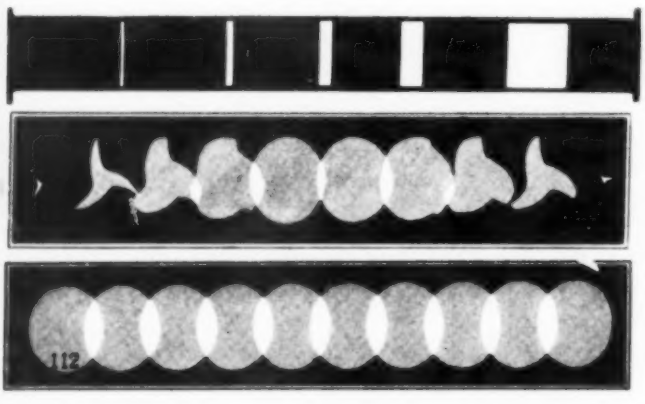
This is the popular "Compur" shutter used on many cameras. The leaves which admit light to the negative are shown here partially open. The numbers around the top outer edge represent fractions of a second: 1 is one second, 2, ½ second, 5, ⅕ second, etc.

CAMERAS are constructed to be light-tight, and yet in order to make an exposure it is necessary to let light into the camera and onto the film. This requires a special mechanism called the camera shutter. It is so designed that when a release is pressed, it will move, let light into the camera for a moment or so, and then close and protect the film again from the light. As films have been made more sensitive and shorter exposures made possible, the design and construction of camera shutters has been improved until today there are shutters that split seconds into almost unbelievably small fractions and let light into the camera for just that fractional part of a second. Most of the smaller hand cameras with which we are familiar are fitted with one, or even both, of two types of shutters.

The first type is built right next to the lens, or more properly, between the elements of the lens. For this reason it is termed the lens-plane, or more commonly, the "between-the-lens shutter." The other type of shutter is the focal-plane shutter, so named because of its position right in front of the focal plane or the position occupied by the film in the camera.

In aspect, the between-the-lens shutter roughly resembles a doughnut. It consists of a circular metal casing containing the mechanism in such a way that a large circular opening is left in the center. To either end of this opening are attached the cells of the lens, hence the name between-the-lens shutter. The light-tight part of the shutter consists of a set of movable blades or leaves, from three to five to a shutter, which control the length of time that light shall pass through the lens. When closed they overlap tightly and when open they pass out of the central opening into the shutter casing.

Early between-the-lens shutters were actuated by a piston working in a cylinder and controlled by an air brake. This type of shutter is quite satisfactory and is still used on large lenses. However, its popularity has recently been overshadowed by the development of a newer and more accurate type of shutter of which the Compur is the leading favorite. This shutter is fitted with a strong spring and a train of gears which controls the action of



Upper left—The curtain of the focal-plane shutter showing the slots of varied widths. Center—Photographic reproduction showing volume of light projected by lens through a between-lens shutter. Below it is a similar reproduction of a focal-plane shutter.

CAMERA SHUTTERS WORK

by T. T. Holden

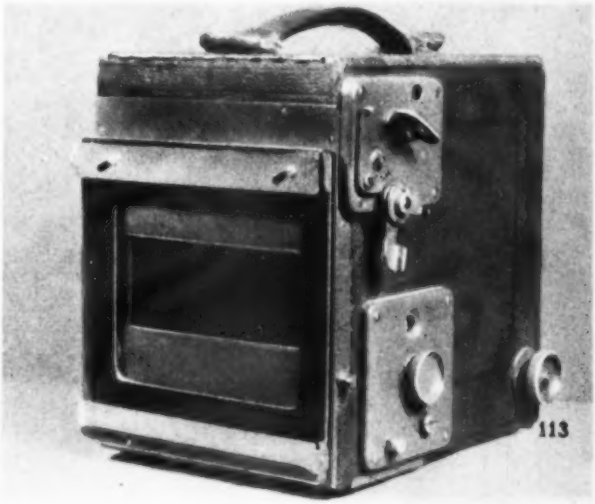
shutter leaves. In some instances this mechanism is so finely adjusted that the leaves open and close in 1/500 of a second. In the newer rim-set Compur shutter, there is an additional set of gears providing a built-in self-timer which delays the actuating of the shutter for approximately twelve seconds after its release.

The shutter casing also contains another set of much smaller leaves which do not close entirely, but which can be moved to produce circular openings of different sizes. These are the leaves of the iris diaphragm, so named because of the similarity of its action and function to the iris of the eye. It will thus be seen that while the shutter leaves control the length of time that light can enter the camera, the diaphragm leaves control the amount of light that can pass through the lens when the shutter leaves are open.

When the between-the-lens shutter is tripped or released the leaves must open from the center, allowing light to pass through that part of the lens first, then through the entire lens, and finally through just the center as the leaves close. Yet to stop the motion of the image moving across the film, the total exposure period, or the time elapsing from the instant the shutter leaves start to open until they close, must not be any greater than the time to which the control dial is set. For instance, if the shutter is set for 1/200 of a second, the leaves must open and close in that time. It can be seen that a certain percentage of that time will be consumed by the opening and closing of the leaves, so that light will pass through the entire lens for only a portion of the 1/200 part of a second for which it is set. The advantages of the between-the-lens shutter lie in its relatively compact size, its position on the lens, and the ease with which it may be synchronized with Photoflash lamps.

The focal plane shutter in its simplest form, as it appears in the Graflex, Speed Graphic and some of the better grade "miniature" cameras, consists of a long curtain or roller-blind. Across this curtain are openings or slots of different widths. When the shutter mechanism is released a slot passes across the film at the back of the camera and light entering the lens can pass through to the film. If the slot is narrow the length of time it will take to pass across any point on the film will be shorter than when a

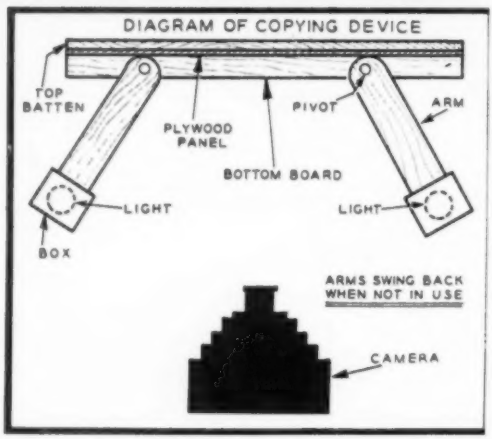
[*Continued on page* 132]



Back view of a Graflex camera with the back removed to show the focal-plane shutter, with one slot visible. Focal-plane shutters are also used on many small cameras of the so-called "candid" type.

COPYING DEVICE

by Everett Rudloff



The copying device pictured above is designed for the amateur photographer who must do his work in limited space. Its use permits photographs, drawings or other illustrations to be copied without loss of detail. Assemble the plywood light boxes and attach to the pivoted arms. Photo mounting board is a plywood panel with battens attached at top and bottom. Pivoted arms are screwed to the bottom battes.

A GREAT convenience in photography is a simple and certain method of making copies. Especially for those who have no elaborate darkroom, this is quite difficult, since the average copying device is bulky and hard to store away in an odd corner. The one described and illustrated here folds up into a flat package that slips into a closet or under a bed, sets up in a moment on any table and furnishes absolutely standard conditions each time so that exposure may be accurately calculated and guesswork eliminated.

The copy support is a large piece of plywood nailed to battens top and bottom. On the front are pivoted two arms that swing out from the board as shown and which carry upright boxes at their extremities. These boxes contain two 50-watt bulbs each, top and bottom, in porcelain sockets, so arranged that the light shines on the board and not into the lens of the camera. Blocks the same height as the bottom batten on the plywood are attached to ends of the arms, enabling the whole arrangement to stand upright.

The camera is mounted on a board that has three rubber feet so it may be shifted forward and backward, yet remain in place when slides are withdrawn, and a spot marked on the plywood on a level with the lens of the camera. Now attach a picture to the board with thumb tacks or transparent scotch

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and the World's Greatest Fun is Riding a

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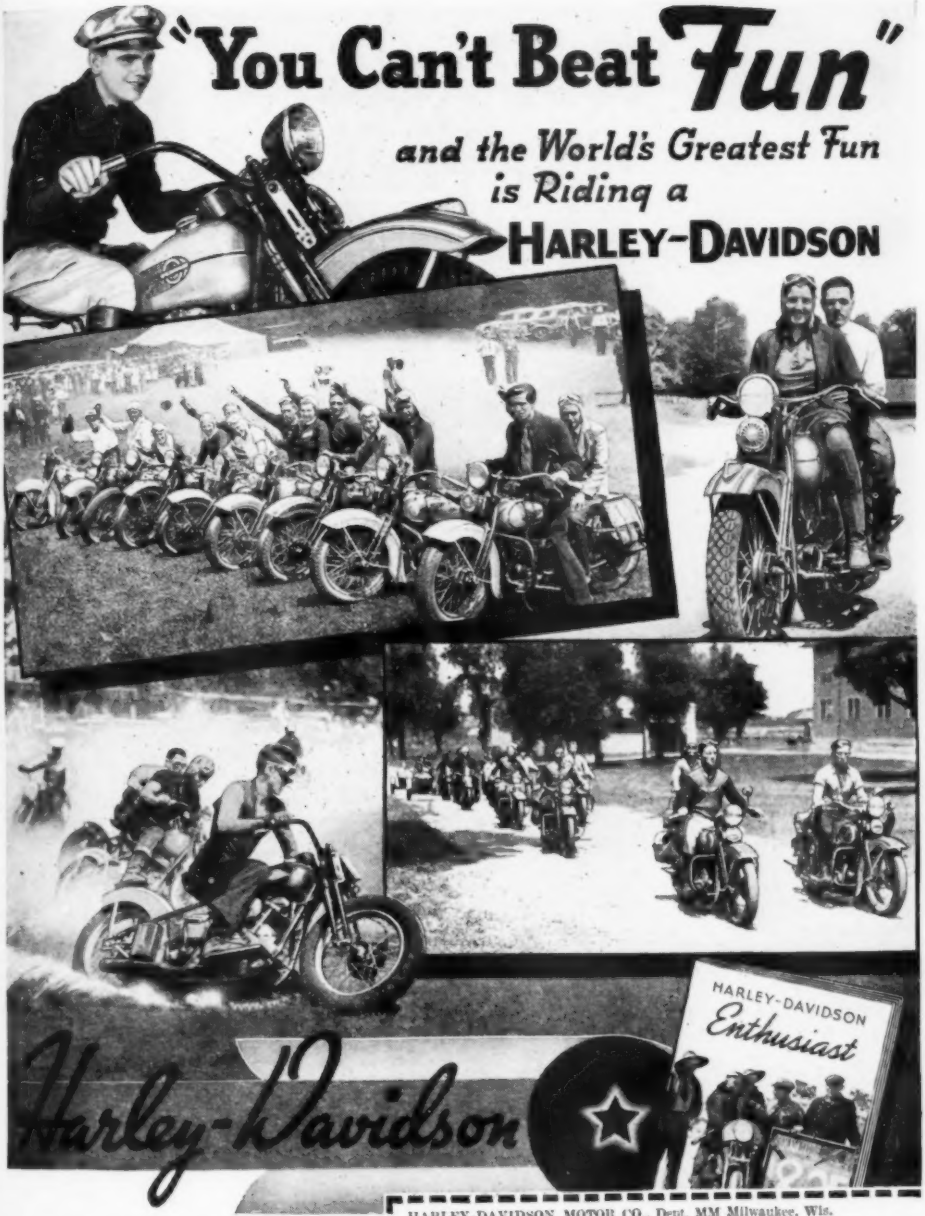

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DISTINGUISHING SCALES ON A CONVERTIBLE LENS

There are three diaphragm scales on the shutter of my camera. Just what they are meant to represent I do not know and would therefore appreciate some information regarding their use.—Richard Daley, Providence, R. I.

The lens on your camera is a convertible type permitting the front or rear parts to be used separately. One of the diaphragm scales is for using the entire lens unit, one for using only the front part and the remaining scale for using the rear part of the lens alone. The three scales are undoubtedly marked either with the focal lengths of the different lens combinations or with R (rear), B (back) and F (front) to identify the elements. When using a convertable lens as a whole, the element with the longer focal length should always be in front.

MEANING OF PROJECTED OR PROCESS BACKGROUND

What is meant by a projected or process background? I have often seen these terms used in connection with motion pictures, but do not know just what they refer to.—Arthur Kingsley, Toronto, Ontario.

A projected or process background is one in which the image in the background is projected on a transparent screen placed behind the set. The screen is shaded from lights on the set so that the action on the screen and stage are photographed together. In the case of motion pictures, the backgrounds are photographed with a motion picture camera, in the usual way, then projected on the transparent screen from the rear with a powerful projector. The film is, of course, placed in the projector reversed, so that it appears in its correct position when viewed from the opposite side of the screen. Using the projected background, it is possible to bring "location" scenes into the studio and avoid considerable expense of sending the company to the actual scene.

HOW TO DETERMINE WHEN FIXING BATH IS EXHAUSTED

While I realize that hypo solutions may be used over and over again, I would appreciate some information that would be more specific as to its exact life and how to determine just when it has become exhausted. Is there any simple way for me to test my hypo solution?—John Sargent, San Francisco, Calif.

In the case of an acid fixing and hardening bath, the time of clearance is a fair indication of the degree of exhaustion. When the time of clearance for a given film is double that required by fresh hypo, the solution should be discarded. Another test consists of adding a few drops of 2 percent solution of potassium iodide to about ½ ounce of fixing bath. If a yellowish coloration forms, the amount of dissolved silver in the solution is sufficient to render its further use questionable.

Another test is to fix a small strip of bromide paper for 2 or 3 minutes, rinsing it briefly in water and then immersing it in a 1 percent solution of sodium sulphide. The appearance of a brown deposit of silver sulphide indicates the presence of unfixed silver halides which, in turn, shows that the bath is no longer able to function satisfactorily.

USING POLAROID SPECTACLES FOR POLARIZING SCREENS

Can Polaroid spectacles be used as polarizing screens over the camera lens so as to shield out objectionable reflections?—Ralph Brown, Philadelphia, Pa.

While the use of Polaroid spectacles as filters for shielding out objectionable reflections and glare will impair the definition of the camera lens to a certain extent, excellent experimental results can nevertheless be obtained. An interesting article on the use of Polaroid spectacles, as screens for reducing glare and reflections from pictures, will be found in the January issue of MODERN MECHANIX on pages 108 and 109 under the title, "Polaroid Glasses Make Glareless Pictures."

RELATIVE SPEED OF PANCHROMATIC FILM WHEN EXPOSED IN ARTIFICIAL AND DAYLIGHT

A photo hobbyist friend of mine says that panchromatic film is faster by tungsten light than by daylight. I am somewhat doubtful as to his statement and would appreciate your advice.—Earl Forrand, Des Moines, Iowa.

When photographing a subject free from color the exposure speed of panchromatic film is not increased by using a tungsten light in preference to daylight. Although some published speeds may show a shorter exposure under tungsten light, these values have been obtained by comparing the exposure required for panchromatic material, with daylight and tungsten illumination, with that required for ordinary blue-sensitive film under the same conditions.

As ordinary film is sensitive to only a small portion of the light emitted by tungsten lamps, panchromatic film will be relatively much faster under the same conditions. Nevertheless, all panchromatic films in general use are actually faster by daylight than by tungsten.

BEST DEVELOPING METHOD

In developing my films I have been determining my work by inspecting it in the tray rather than using a fixed time method. It is said in some photographic manuals that only the time and temperature method will work satisfactorily if good results are to be obtained. Is this true?—Marie Wells, Oakland, Calif.

Due to the fact that the emulsions of most films are very sensitive to light it is poor practice to examine them under the safelight. Doing this will often fog the image. Speed films as used in night photography should be developed in total darkness. Here it is essential that the time and temperature method be used. In all cases develop your films according to instructions printed on developer package.

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Man Makes His Own Rubber

[*Continued from page 52*]

conditions that Dr. Nieuwland had used it was possible to convert acetylene to another chemical known as mono-vinyl-acetylene. It was hoped that a good artificial rubber could be made from this chemical, but again the experiments were unsuccessful.

The chemists who were working on this problem, however, refused to believe that it could not be done. They continued their work, and a few years later they found that by treating mono-vinyl-acetylene with hydrogen chloride gas they could produce a new channel which had never before been made and which they christened chloroprene.

Chloroprene is a volatile liquid; it certainly does not bear any resemblance to rubber. But the next and most startling discovery of all was that this liquid chloroprene can easily be converted to a tough, elastic solid. Imagine the elation of the chemists when they found that they had at last produced what chemists had been striving for so many years and had failed to find—an artificial product that is fully equal to natural rubber in strength, toughness and resistance to abrasion.

But the real thrill came a few weeks later when they proved that this chloroprene rubber is actually superior to natural rubber in many ways. They had not produced a synthetic rubber but had made something immensely more valuable—an elastic material that is superior to natural rubber.

The first step in the manufacture of neoprene is to heat coal and limestone in an electric furnace, producing calcium carbide, designated by chemical symbols as CaC_2. The next step is to add water to the calcium carbide and produce acetylene gas (C_2H_2).

There is nothing new about the manufacture of calcium carbide and its conversion to acetylene gas. Everyone who is old enough to remember the early days of the automobile will recall the acetylene generators that were usually mounted on the running board in which grayish lumps of calcium carbide were treated with water, producing the acetylene gas that was burned in the headlights. However, the next step in the manufacture of neoprene carries us into a new realm of chemistry. Acetylene gas is treated with a catalyst in specially-designed apparatus made of new corrosion-resisting alloys with the result that the acetylene molecules combine with one another to form a previously unknown chemical compound, mono-vinyl-acetylene. Mono-vinyl-acetylene, also a gas, is then put into another catalyst chamber where it is caused to combine with hydrogen chloride gas. The intermarriage of these gases produces another new chemical, chloroprene, which, strange as it may seem, is no longer a gas but a liquid.

The final step in this chain of chemical miracles is to subject liquid chloroprene to a polymerization process which causes the molecules to combine, producing a tough, rubber-like solid which is known as neoprene.

The perversity of chemical reactions is such that the materials being combined often tend to react not in the desired manner, but to combine in different proportions with the production of unwanted impurities or by-products. The problem of the chemists and engineers who were charged with the responsibility of making this process work was to design equipment and methods of chemical control which would make the reactions follow the desired channels and produce neoprene having a maximum degree of strength, toughness and elasticity.

It was not an easy problem. The first special equipment designed for the job did not work satisfactorily. Changes were made and again the results were disappointing. The process was further modified and the result was more disappointments, but in the end the problem was solved and now in 1938—seven years after the first experimental factory was built—a huge chemical plant is converting millions of pounds of calcium carbide into neoprene. Apparatus and equipment unlike anything the chemical industry ever before knew made it possible for manufacturing chemists to direct these reactions in the desired channels, keep them under control, and produce an even better product than was originally made in the chemical laboratory.

Neoprene resembles natural rubber more closely than any other artificial product. The X-ray discloses that its physical structure is the same even though its chemical composition is different. It looks like crude rubber shipped from the rubber plantations and is mixed with other materials, processed, and vulcanized by rubber manufacturers just like the natural product. But although the finest articles look like those made of crude rubber and have the same elasticity, stretch and toughness, they, also have the ability to resist the action of oils, gasolines and solvents which destroy rubber. They resist heat, and direct sunlight does not cause them to check and crack so readily. They resist the passage of gases and have a much longer, useful life than like articles made from nature's product.

Science Battles Fog Menace

[*Continued from page 45*]

silent period, and a five-second synchronized note. The navigator presses a stopwatch when he hears the start of this radio note, then listens for the fog horn signal.

Since for all practical purposes radio signals are transmitted instantaneously, while sound travels a sea mile in approximately five and one-half seconds, a simple problem in mental division will give the navigator his approximate distance from the lightship. It is also possible to obtain a stop-watch made especially for this purpose, with the dial graduated into miles instead of seconds.

This device works splendidly if the fog horn is heard, but sound waves are notoriously unreliable. All mariners know that a noise that is heard distinctly miles away may be inaudible close at hand. A few years ago a ship ran aground only 200 yards from a fog siren which nobody on board heard, yet the wail of that siren disturbed the slumber of persons on shore twelve miles away.

The very atmospheric conditions that produce fog are responsible for this distortion of sound waves, according to Dr. W. J. Humphreys of the U. S. Weather Bureau. Sound travels faster in warm air than in cold. With a thin layer of warm air over the water, and a colder layer above, the bottom of the sound wave will travel faster than the top, thus deflecting the wave upward, just as dragging one foot will turn a sled. If the sound waves encounter another warm layer of air above, the process is reversed, and the sound comes back to the surface, to be heard perhaps miles away.

Without the radio as a guide, sound may also be misleading as to the direction of its source. Sound waves travel in everwidening circles, like the ripples when a stone is dropped into a still pond. A strong wind will distort the circle into an elipse. Since the source of sound always appears to be at right angles to the front of the waves, a strong wind might so distort the waves as to make the apparent source as much as 90 degrees from true. By causing echoes, nearby land, or even the front of a fog bank, might also deceive the hearer as to the direction of a sound's true source.

The tone of a sound also has much to do with its directional qualities. A very deep note, such as is used on the steam whistles of most of the larger liners, carries a surprising distance, but even in clear air the listener has trouble in identifying the direction from which it comes. A very high note, such as a policeman's whistle, has very high directional qualities, but can be heard a comparatively short distance.

The Lighthouse Service has been studying the qualities of various tones for years, and attempts to select a note for each fog horn or buoy that will best serve the purpose for the particular location being considered.

With a lightship, distance is more important that direction, and the fog-horn tone is fairly low. With many buoys in a crowded harbor, direction is usually paramount, so the whistles, bells, gongs and sirens will have a comparatively high tone. Where both qualities are important, such as with the large sea buoy two miles off the entrance to Ambrose Channel, a delicate compromise has to be reached in the tone of its whistle.

Several of the more important lightships, such as *Ambrose* and *Fire Island*, are equipped with submarine bells and *Nantucket Shoals* lightship is equipped with an oscillator, synchronized with the radiobeacon signal in the same manner as is the fog horn. Sound travels about 4,800 feet per second through water, the speed remaining constant under all conditions. Under-water sounds are not subject to zones of silence, as are sounds transmitted through air, and the waves travel greater distances before dying out. Distance finding by submarine signals is thus free from some of the uncertainties attached to the transmission of sound in air, although factors having to do with the speed of the ship, the draft, the location of the microphones, etc., are important, and every ship is not equipped to receive such signals. The *Olympic* was so equipped when it ran down the *Nantucket*, but that did not prevent a collision.

As the name indicates, lightships are equipped with powerful lights in addition to their radio and sound signals, but lights are practically useless in a fog. Large ships must run so fast to maintain steerageway, that when a light is sighted in a heavy fog it is usually too late to stop or turn out of the way. Increasing the strength of a light seems to have little effect on its power to penetrate a fog. A hundred candlepower light might be seen 100 yards in a particular fog, while a million candlepower light would penetrate the same fog only 200 yards.

Another important aid to navigation that makes use of the uniform speed of sound through water is the fathometer. This device consists of an impact oscillator that delivers a sound of great intensity through the skin of the ship, a hydrophone to pick up the sound when it returns as an echo from the ocean's floor, an amplifier that changes the

[*Continued on page 120*]

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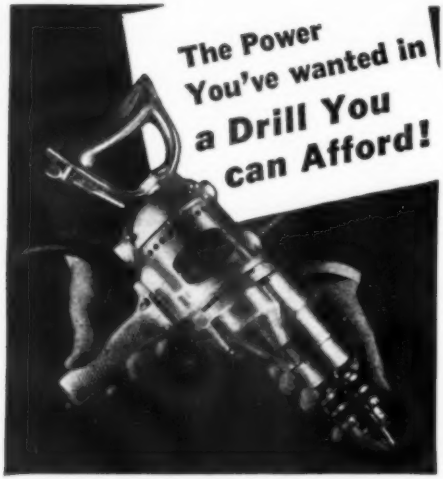

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Science Battles Fog Menace

[*Continued from page* 118]

sound waves into electrical impulses, and an indicator that translates the time interval between sending and receiving into light flashes on a calibrated dial.

By taking frequent soundings with a fathometer, the navigator may compare the readings with the chart, and not only know how much water he has under his keel, but have a very good idea of his location. Twenty-four soundings a minute may be taken while proceeding at full speed, in contrast to the time-honored method of swinging the hand lead, which required almost ten minutes, with the ship almost stopped, to obtain a sounding.

Owing to the extreme speed of sound through water, the fathometer is not accurate enough to be of value when it is needed most—when it is foggy and there are only a few feet of water under the keel. It will show the difference between fifteen and seventeen fathoms of water accurately enough, but when it comes down to determining the difference between five and six feet, the navigator must feel his way with the hand lead.

When the fog has closed down, and the captain, or the harbor pilot he has picked up, is faced with the ticklish job of bringing the ship through the narrow channels of a harbor entrance, not only the ancient hand lead, but the lowly buoy, are the things he depends upon most. A buoy can be moored out in deep water, close to the track of the vessel, without adding another hazard to navigation. Running one down may wreck the buoy, but will do no material damage to the ship.

Buoys have certain characteristics to indicate their position relative to the channel, or to obstructions. As a ship enters a harbor it will find red, conical-topped buoys, called "nuns," marking the right of the channel, and black, flat-topped buoys, called "cans," on the left. Isolated middle ground or danger buoys will have stripes of red and black. All will be numbered, odd numbers to the left and even numbers to the right, and these numbers will be indicated on the chart, making it possible to fix the position definitely, once one is sighted.

Certain buoys on the right will carry red or white lights. Those on the left will show lights of white or green. Some of the lights will shine steadily, while others will flash for varying periods, making it possible to definitely identify them in the dark.

If the fog is so dense that the buoys cannot be seen even close at hand, certain of them will have identifying sounds, such as whistles, gongs, or bells, all sounded by the action of the waves. It is now possible to equip buoys with low-powered radiobeacon transmitters, although the Lighthouse Service has not yet adopted this equipment. Cable companies are now successfully using such buoys to mark the ends of severed cables.

A fogbound ship entering or leaving a harbor will feel its way slowly from buoy to buoy, following a compass course and keeping track of speed and time accurately. With buoys only half a mile apart, it is seldom one is missed; but if the pilot does miss one, down goes the anchor immediately.

Making An Inlaid Footstool

[*Continued from page* 73]

Bore the 3/8-inch holes for the leg dowels 3/4-inch deep around a lightly scribed line on top of the base. A drill press will make short work of this step, insuring even-depth holes and accurate alignment. Sand, rub with steel wool and give a heavy lacquer coat. Be careful to prevent lacquer from getting into the dowel holes. Patting the finish on with the brush held flat will help.

Either the jig or band saw can be used to cut out the legs from a pattern shaped as shown in the details. Note that the lower end of each leg sets 1 inch in from the top. Sand all surfaces smooth. Bore the holes 3/4-inch deep. If a shaper is accessible, slightly round each corner. Lacking this, sand off the sharp edges. Glue the top in place first, align the legs by sighting along pairs, then glue the base in position. Cut off the remainder of the knob left when recessing the base, at the center, with a chisel.

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Discloses Identity In Fur

[*Continued from page 97*]

as to avoid mixing; include a tiny slip with the animal's name written in India ink or else a key number referring to a card index record.

In making identifications, begin with a study of the outermost layer of a hair, the cuticle. This sheath is made up of a great number of minute scales which vary in their disposition and shape. Two main types are recognized, the imbricate and coronal. Imbricate scales overlap around the hair shaft, there being more than one encountered in making a circumference; coronal scales encircle the shaft as a continuous band, often presenting the appearance of a crown. Both types are shingled, the lower scales overlapping the upper.

Subdivisions are named according to the shape of individual scales. Among imbricate scales are the ovate (oval in outline), acuminate (pointed), elongate (larger and longer than the acuminate), crenate (notched or wavy outline) and flattened (like ovate but very low and flat). The crenate variety is commonest of all and the flattened is also often encountered. Sparse hair and coarse or spiny hairs are invariably of the flattened type.

Coronal scales are designated according to the appearance of the border as simple (plain border), serrate (edge saw-toothed) or dentate (bluntly-toothed). The first two of these are characteristic of various bats and because of their beautiful appearance under the microscope, bat hair is in demand by microscopists. Mink and otter exhibit the dentate pattern.

Next below the cuticle comes the cortex (bark), composed of spindle-shaped cells that are so compact the whole layer appears transparent and uniform. Keratin, or horn similar to that of our finger nails, is deposited among these cells and gives to the hair shaft its characteristic cornified (horny) appearance. Also in this layer occur various pigments granules, usually responsible for the color of hair. These granules are scattered between and within the cortical cells in a fairly regular design that is sometimes of aid in making identifications.

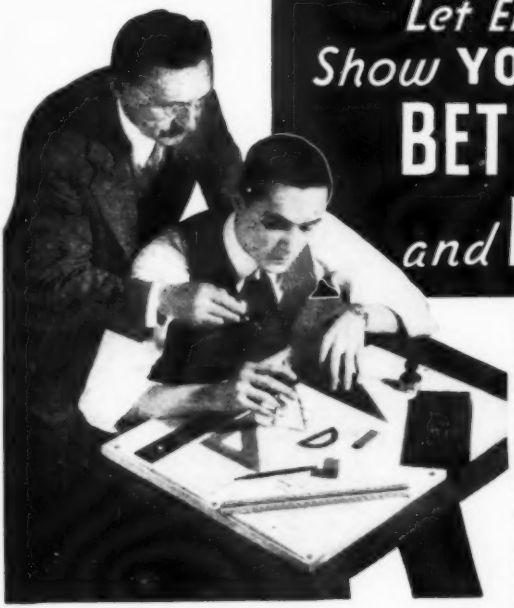
Lastly there is the innermost part, the medulla (pith), with its material disposed in a column running lengthwise of the hair shaft. In this column are sundry shrunken cells, spaces and dried and horny epidermal structures, the pattern of which is characteristic of each species. Unstained hairs are necessary for microscopic examination of either cortex or medulla and so if stained specimens are used for study of the scales, mount both stained and unstained material on the same slide, so that complete determinations can be made.

Medullas are classified first of all as simple or compound. Simple medullas have only a single strand of material running through the hair and comprise three types: continuous (a more or less solid rod), fragmental (isolated patches probably resulting from a breakdown of the continuous type) and discontinuous (separate blocks lying one above another, regular in arrangement). The compound medulla is rare and shows two or more parallel columns of the discontinuous style, side by side. Shapes of the individual elements of these conditions are described with terms like those used with the scales. Thus one may have a simple discontinuous ovate medulla, the word ovate referring to the shape of a single medullary block. Continuous medullas are either homogeneous (straight and plain) or nodose (with constrictions or irregular outline).

Color of a hair specimen is sometimes helpful in identification, though since it varies with sex, age or part of body in many species, differs throughout the extent of a single hair, and is easily altered with dyes, it is of only minor importance. Size and particularly average ranges of size are used somewhat, being more or less constant within known limits. These diameters are measured in microns and determined by means of a micrometer eyepiece.

With all this data at immediate disposal, nature of cuticular scales, pigment granules of the cortex, medullary structure, color and size, it may readily be appreciated that many thousands of combinations of all of these factors are possible and that the hair of no two species of mammals will be exactly alike.

Make your own sketch drawings of the cuticular scales and types of medullas on cards and file these by scale pattern, cross-referenced to medulla and to a file of the mammals listed by name, arranged alphabetically. Do this only for those species of whose identity you are positive. For keys by which unknowns may be identified, see one of the two following articles: Hausman, L. A., "Structural Characteristics of the Hair of Mammals," The American Naturalist, Vol. LIV, Nov.-Dec., 1920, pages 496-523, or by the same author, "Mammal Fur Under the Microscope," Natural History, Vol. XX, No. 4, 1920, pages 434-444. These journals are on file in the larger public and college libraries.



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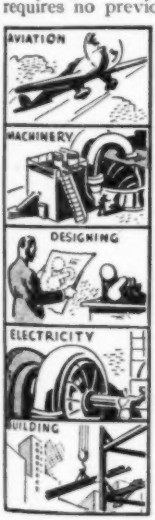

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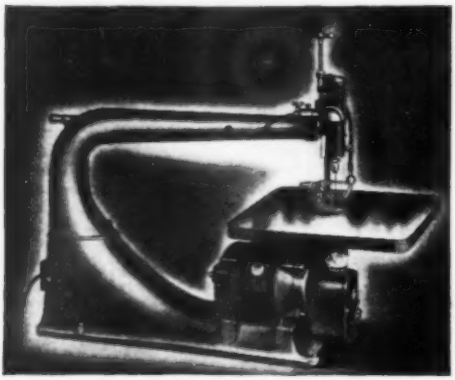

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DRIVER *Engineered* POWER TOOLS

Build This Sturdy Band Saw

[*Continued from page* 83]

manner indicated on the drawings or by some similar means. The packer bearing used for this purpose on the original was taken from an old grain binder. Slots should be provided in the frame to permit alignment of the wheels. These are not shown in the drawings but *are essential!*

The blade guard may be two brake bands riveted together (see Fig. 9) and passed round the drums as shown in the drawings.

A handsome table can be made by alternating strips of black walnut and maple as shown in Fig. 1. Assemble with ⅜-inch dowels and glue with water-proof casein glue. The table is supported by a column which is simply a Ford T connecting rod. The journal end is bolted to the saw frame from beneath the frame. The table pivots on an Overland piston pin which is clamped into the upper end of the connecting rod. The brackets used to pivot the table on this pin are shown in Fig. 1. The upper half of each bracket is screwed into the bottom of the table, exact position being determined on the job.

The lower guide roller is part of the table column assembly. As shown in Figs. 1 and 7, a steel roller is pinned to the piston pin and is adjusted by sliding the column on the frame and the piston pin in and out of its anchorage.

The upper guide assembly is clearly shown in Fig. 6 and requires but little explanation. A length of ⅝-inch steel rod slides in the collar and may be held in any desired position by means of an adjustment screw. At the lower end a piston pin is anchored and in turn carries two rollers which engage the saw blade. The fitting used to secure the piston pin on the original was a casting taken from an old grain binder. A satisfactory and practical substitute is shown. The ⅝-inch rod is traversed to fit the ½-inch pipe tee, and the piston pin slides in the tranverse portion. Ream the pipe to fit the piston pin if it is too large and bush the tee with babbit if the pin comes too small. Slots cut into the saw frame as shown permit the entire guide arm to be adjusted in line with the lower guide. The rollers were taken from push rods off an old tractor.

The tension of the blade is adjusted by means of the ½-inch pipe previously mentioned. The lower end of this pipe rests over a ½-inch bolt which is screwed into the frame and projects for this purpose. At the top of the frame a ⅝-inch bolt is used with a slight shoulder turned into it as shown in the detail sketch on Fig. 5. This bolt bears down to fit inside the pipe, the shoulder bearing on the pipe edge itself. Turning the bolt thus forces the frame apart to increase the blade tension.

By means of a spectograph—an optical instrument—very tiny amounts of lead in the brain of an individual can be detected.

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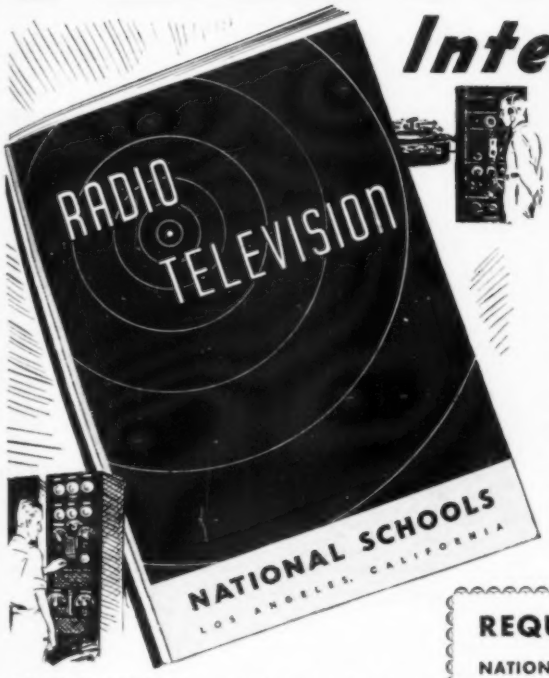

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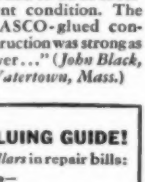

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Composite Photography

[*Continued from page* 109]

to do battle with a "prehistoric" monster which appears to tower far above the man as it comes over the brow of a hill. In making this picture, the first step was to make the picture of the bug. For this purpose, a dead rhinoceros beetle was obtained from a bug collection and placed upon a small square of sod set upon the studio table. A white cardboard background appears as sky, and the towering effect was obtained by placing the camera lens an inch or two lower than the bug, and pointing up at it. A time exposure by the light of a window produced this first negative.

The next thing done was to get the picture of the hunter. Carefully measuring on the bug negative the height at which I wished the hunter to be, a second negative was made, (outdoors) of the man, getting far enough away to get an image of the size to correspond with the idea of the picture. This was ascertained by measuring the image of the hunter on the ground glass with a small ruler before inserting the plate and making the exposure. When prints of both negatives had been made, the figure of the man and gun was cut out with a scissors, scraped to extreme thinness at the edge, and pasted to the surface of the bug print. This was then copied exact size through the same camera on process film to obtain good contrast.

The procedure was exactly the same with all the other pictures. In the potato view, the man pushing the wheelbarrow was made first, then the potato photographed to correct size, and pasted on. The man shaking hands with his tiny counterpart is another example of what can be done, in this case both photos being taken out of doors, with the light coming from the same direction.

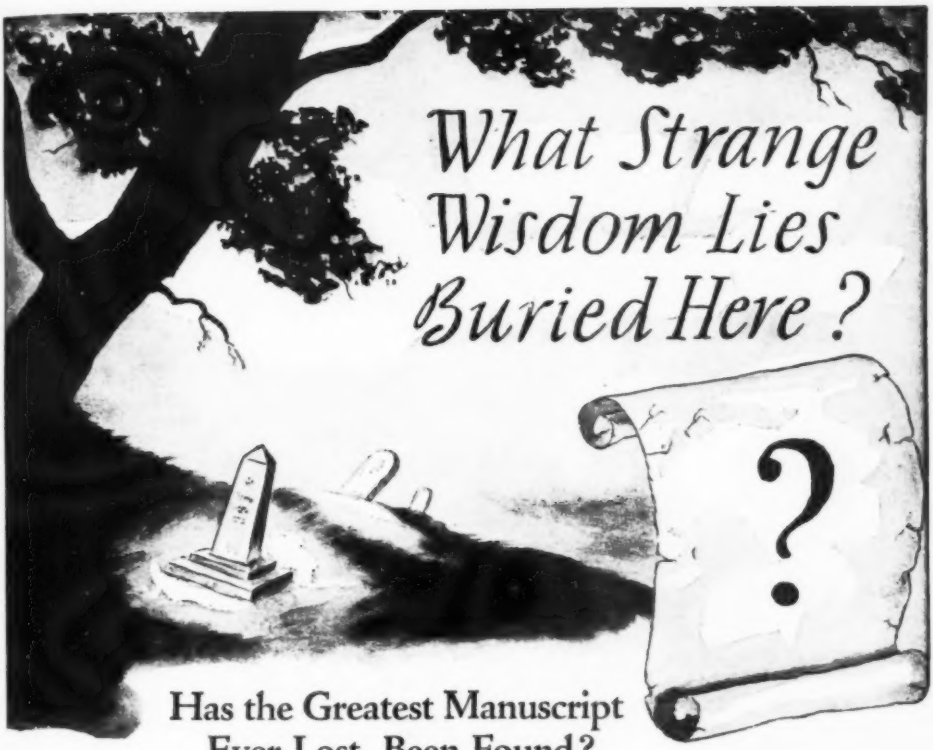
This is one thing that should be noted when selecting pictures to be combined together—the lighting should be coming from the same, or nearly the same, direction in both prints. To go back to the print of the bug and hunter, notice how the light is coming from in back of the bug and striking the hunter in the face, as though both coming from the same source, yet one was made outdoors, the other in the house. Scraping the edge of the print, as illustrated in one of the photos and mentioned before, is done to make the edge extremely thin, so it will lie as flush as possible with the surface of the larger print when pasted down. This will eliminate the possibility of the edge of the paper showing in the copy as a light or dark line. The edge may be scraped with a razor blade, or even rubbed down with fine sandpaper, but of course you should be careful not to wear down or remove bits of the edge of the picture itself.

A few other effects possible, just to start your imagination to working, would be to have a large image of yourself towering above your home, which is reduced in size to look like a small doll house. Or to reverse the procedure, you could be small enough when placed upon your doorstep to make the house look like the abode of a giant. If you are a flower or garden enthusiast, have a picture of yourself walking through your garden, with the blooms of the poppies towering far above your head, or show yourself attacking one of your cornstalks with an axe. A fisherman could be shown with a trout or bass being brought home on a truck, as an example of one that did not get away.

But such bizarre examples are not the only uses to which combination photography may be used. If you have photos of two or more of your friends or relatives taken separatively, these may be combined into one picture to look as though they were all taken together. Size of the different prints does not matter, as the images may be reduced or enlarged in the camera to correspond.

Another thing that is important is copying the prints to obtain even lighting. Of course, if you have regular copying equipment, this becomes a simple matter, as the lighting is part of the equipment. Any camera with a ground glass back and which uses plate or film holders may be used for copying. Extending the bellows to full length enables you to get up close enough to the print to get a large copy. The camera should be set on a table or tripod, and the print on any suitable support, so it is *exactly* parallel to the ground glass, and centered with the lens. By having the print directly facing the window, flat lighting may be obtained, or by placing the camera so light will fall on it evenly from two windows. By doing the latter, you will have no difficulty in light reflections from the surface of glossy prints, which sometimes ruin the copy.

Ordinary film or plates are not suitable for making the copy negatives, as they do not have enough contrast. Special film and plates, known variously, as slow, copy, or process, have much more contrast, and are obtainable for any plate camera. These films are from five to ten times slower, however, than regular film, so give from five to ten times the exposure. As a rule, these films and plates give more contrast with overexposure than with underexposure. All the photos illustrating this article were made this way. The originals were on regular portrait film, the finished combination copies on process film.



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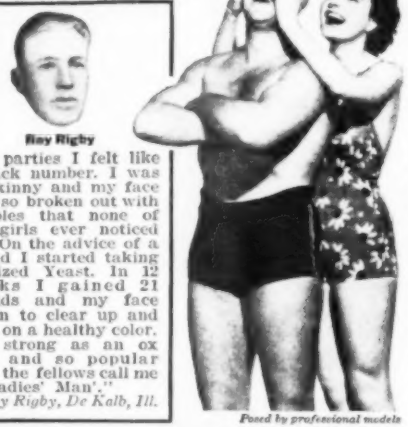

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You Can Learn Glass Blowing

[*Continued from page* 78]

bulb with walls so thin that they immediately collapsed. This is avoided by gathering the glass so as to thicken the walls of the tubing. As an experiment, heat the middle of a short piece of glass, and while rotating it uniformly, gradually and carefully bring the hands together. This must be done slowly and with judgment. You will find that the walls of the heated part of the tubing will become thicker and, if you wish, the bore can be entirely closed. Cork the end of one spindle and blow *gently* into the other, meanwhile continuing the rotation. The heated glass will expand into a more or less perfect bulb, according to the amount of skill you have acquired, and the walls will be thick enough for practical use.

In this connection, the blowing of different sizes and shapes of bulbs in a single piece of tubing is excellent practice and will provide skill in handling glass.

Making a Beverage Sipper: A glass "straw" for sipping cool drinks is an easy project to commence with, and they make very attractive and useful bridge prizes. Choose a piece of narrow tubing and heat one end until a considerable amount of glass has been gathered. Blow into it very gently to form a thick-walled bulb about ¾-inch in diameter, then while the glass is still hot, almost flatten it with a tweezer-like tool made by bending in half a narrow piece of spring brass. Suction applied to the open end of the tube will make the sides of the flattened bulb concave. Heat and bend it at an angle to the stem, then heat a small spot, blow hard into the tubing and a hole will be formed. This can be made smooth by further heating. Make the stem to the desired length by cutting it with a triangular file and then tapping, when it will part neatly. Heat the mouth of the stem to smooth and round it. The stem can be heated and bent in the middle if desired.

Flower Vase: Cut a 12-inch piece of your largest tubing and at 3 inches from one end gather the glass together, closing the bore, to form the stem. Gather more glass immediately next to the stem, then gently blow it out into a small bulb. Before the glass has cooled, bring the hands together so as to "squeeze" the bulb to shape. Blow six more bulbs, closely adjoining, in the same manner. The ends are flared, to form a base and mouth respectively, by rotating the heated glass against a spear-shaped tool made of sheet steel or heavy brass. Lips are formed around the mouth with a sharp corner of a putty knife ground to a triangular shape.

A distinguishing feature of handmade work is that it is seldom uniform, otherwise it would be in the same class as machine-blown glassware. For this reason it is not necessary, or advisable, to try to make the vase absolutely perfect.

Uncle Sam — Model Maker

[*Continued from page* 60]

of tiny model buildings, the largest of which representing an 80-ft. building, is but one-half inch high; yet all are to exact scale! The CCC boys spent four months building this model. Historic battlefields of the East are being reproduced in miniature, so that students of history, military men and just plain citizens can understand more readily some of the highly important events that have helped shape the history of the United States.

In all, the making of models and relief maps, inaugurated primarily as a relief project, has proved to be a worthwhile investment. Those in contact with the work estimate that the money to be saved by the models when used in conjunction with the building of roads, fighting forest fires, planting trees and doing other things in the areas mapped, eventually will pay for the work many times over.

Nearly all of the actual labor of building models and maps is done by CCC boys who, when first assigned to the model laboratories, are totally unfamiliar with the exacting work. The skill developed by many of these young men in a comparatively short time continues to amaze even the experienced technicians who supervise the work.

The making of a relief map proves to be one of the most interesting processes. These maps are based on topographic maps and surveys that already have been made, paper maps on which winding lines show the contour and height of every point in the region.

First the scale of the relief map is determined, and cardboard of the proper thickness selected for building up the form. Thus, if a map whose contour lines represent differences in elevation of 50 ft. is to be reproduced on a scale of 1 in. equals 500 ft., cardboard 1/10 in. thick would be employed.

[*Continued on page* 130]

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WHO BUT INDIAN could bring you engineering triumphs like these new 1938 motorcycles at such smashingly low prices! These great new Indians have *everything*—easy handling, power, pep, economy, and all the thrill and adventure of motorcycling.

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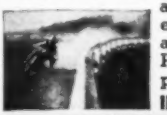

INDIAN MOTOCYCLE CO., Springfield, Mass.

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Please send me at once, without obligation, your illustrated Folder showing the new 1938 Indian Motocycles, and CERTIFICATE of VALUE entitling me to FREE RIDER'S HELMET and INDIAN PIN, as illustrated, when I place my order.

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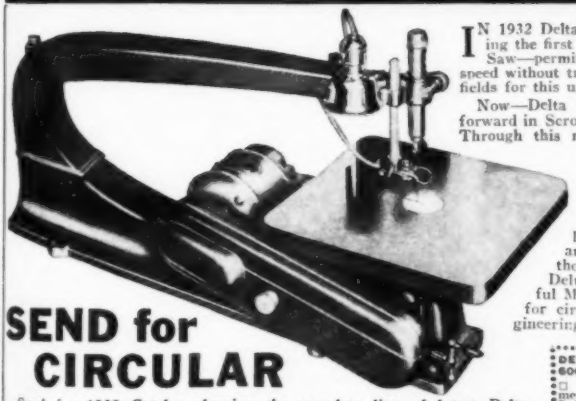
Address.....

Please be sure to check your age group: MM2

☐ 16-19 years ☐ 20-30 years ☐ 31 years and up ☐ under 16 years

Revolutionary New Scroll Saw of a THOUSAND SPEEDS



IN 1932 Delta scored an engineering triumph by introducing the first practical High Speed, Large Capacity Scroll Saw—permitting the running of the saw at full motor speed without troublesome vibration—and opening many new fields for this useful tool.

Now—Delta is happy to announce a *second* great step forward in Scroll Saw design—Perfected *Multi-Speed Drive*. Through this remarkable development you can select *any speed you want* from 790 to 1700 R.P.M. regulating the speed within 1 or 2 R.P.M. if you wish. You can cut any material within the range of the scroll saw with full assurance that you have the best speed for your purpose. Furthermore, scientific design has made this improvement simple, foolproof and trouble free. If you are one of the many thousands who already own a No. 1200 Delta Deluxe Scroll Saw—you can obtain this wonderful Multi-Speed Drive at very small expense. Send for circular giving full story of this unusual engineering achievement.

SEND for CIRCULAR

Send for 1938 Catalog showing the complete line of latest Delta motor-driven tools and special circular on new Multi-Speed Scroll Saw—and the latest Delta Project Book No. 4—packed full of new and different things to make, with many photographs, working drawings, and complete instructions. Enclose 10c for Project Book. Catalog will be mailed postpaid.

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☐ I enclose 10c (stamps or coin) for which please send me one copy of the new 1938 Book No. 4 of "Practical Delta Projects." Also place me on your mailing list to receive 1938 Delta catalog of quality motor-driven woodworking tools.

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MAKE $25 TO $30
PER WEEK AT HOME
IN YOUR SPARE TIME

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Like magic, the Ideal Lawnmower Sharpener makes old, dull, half worn-out mowers cut like new. Simply set the mower in the Ideal and the machine does the rest. Sharpens any lawnmower to a perfect edge in 15 to 20 minutes and you make $1.00 to $1.50. Attach to light socket. Start in your basement or garage. Work in spare time. Attachments furnished for grinding skates, grass shears, hedge shears, sickles, scythes, axes, etc. FREE CATALOG tells complete story.

WHAT THESE MEN DID .. You Can Do

Remember, no experience is necessary. Most men sharpen lawnmowers in spare time only. A. V. Gebhardt writes: "Have made $1000.00 the past 6 months." George Seitel writes: "I have sharpened over 500 mowers and every customer is well pleased." A. M. Larsen writes: "I average 9 mowers a day." Roy F. Stier says: "I live in a town of 500 and to-date have sharpened 200 mowers at $1.25." Edward A. Mynderse writes: "Have sharpened around 500 mowers this season." Nick Baltes says: "Last summer I sharpened 200 mowers at $1.00 each." Bucher Battery Co. write: "We sharpened over 600 mowers last year at $1.50 each."

FREE BOOK Shows how!

Right now, before you forget it, send for a copy of our FREE BOOK, "How To Make $25 to $30 per week in SPARE TIME."

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For several years, Diesel engines have been replacing steam and gasoline engines in power plants, motor trucks and buses, locomotives, ships, tractors, dredges, pumps, etc. And now the first Diesel-powered passenger car is on the market. Our home-study course offers you a real opportunity to prepare for a worth-while position in this new field. Write TODAY for full information. No obligation.
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STANDARD ART STUDIOS, 104 S. Jefferson St., Dept. 378-B, Chicago

Uncle Sam — Model Maker

[*Continued from page* 128]

The map-maker first traces, on a sheet of cardboard, the two outside contour lines, those representing the lowest level of the region. With an electric cutting machine such as used for cutting jig-saw puzzles, he cuts the cardboard along the outside contour line. Then a second piece of material is traced with the second and third contour lines, and the outside (second) line cut. The smaller cardboard layer is then glued to the larger, its edges matching the uncut contour line traced on the lower piece. This is repeated until the map is roughed in and consists of a series of cardboard layers whose edges form steps.

At this point a fair idea of the surface of the area being mapped can be obtained by looking at the model. The terrain looks, however, like an area covered entirely with terraces. So a sculptor goes to work, and fills each tiny step with clay, moulding it carefully to conform as nearly as possible to the original contour of the ground. The application of moist clay does not change the shape of the map, for glue that does not expand or shrink, and is not otherwise affected by moisture, is used in assembling the cardboard layers.

The map now resembles a pasteboard cake with clay icing. Plaster of Paris, is then poured over it, to make a negative cast of form. From this negative a number of durable positive casts can be made. These consist of a combination of plaster, plastic wood and celluloid. To give the model a hard surface, so that the fingernails of curious spectaters, and other abuse will not mar it, the whole model is sprayed with a celluloid coating. Over this is applied whatever paint or other materials may be necessary. Various means are employed to make the maps look realistic, or to bring out certain important features. Thus, over forest areas, ground cork, stained green, is applied, to simulate the appearance of the actual region.

Copper Ware For Craftsmen

[*Continued from page* 93]

a ⅞-inch iron bar. The saucers are made from 18 gauge copper, 2¾-inches in diameter, and raised as shown.

The cups are of ¾-inch (outside diameter) copper tubing, 1¼-inch long. Hammer them on the outside, then place one end over the horn of the anvil, or a solid round bar, and flare the ends out slightly. Drill holes, and rivet the column to the base. Solder the cups in place in the saucers and to complete the pieces, polish and lacquer.

The attractive ash receivers were designed with the idea of keeping the misused bridge table cover free from cigarette ashes. Once clamped to the edge of the bridge table, they will stay put. A set of four of these pieces is a worth-while project for any craftsman.

The bowl is a 3-inch disk of 16 gauge soft sheet copper, cupped or raised to a depth of about ⅞-inch, with the top rolled in slightly. Hammering is done with a ball pein hammer. The copper will have to be annealed about three times in order to raise the bowl to the required depth without hammering the metal so hard that it will crack through.

The clamp is cut from the same material and hammered hard to make it springy. The cigarette rest is formed and the piece bent into shape. Drill holes and rivet to the bowl with a number 14 brass escutcheon pin. The pin allows the clamp to swing up along the side of the bowl so that the ash receiver may be set down on the desk or table if desired.

The trays may be finished in polished copper or they may be coated with a nitrate of copper solution and burned black, burnished with fine emery paper, and polished with floor wax. Lighted cigarettes will not affect the latter finish.

Metal stand picture frames are very popular, and they too are very easily made. The frame illustrated is made from 18 gauge soft sheet copper to accomodate a 5 by 7 inch picture.

Cut out the base piece and hammer on one side with a planishing hammer, then roll the two ends under, around a ¾-inch bar. The upright is cut out, and hammered in the same manner on what will be the outside.

Place two hard wood blocks in the vise, and slip the bottom edge down between these up to the dotted line and bend forward sharply. Then place the side between the blocks, up to the first dotted line, and bend forward. Place a piece of flat steel ¼-inch thick tightly against the bent up side, and clamp in the vise and bend the piece forward to form the guide for the glass. Bend the other short side forward and the round disk up on the dotted lines. These operations are photographically illustrated. Holes may be drilled and the upright riveted to the base, or the pieces may be soldered together.

$200 My First Week

...Now in my OWN Business.

Would you, too, like to own a business where you could take in $200 your first week as did L. A. Eagles in Madison, Wisconsin?

We want a reputable, honest man in each county. This man need not have any special experience or more than ordinary ability, but he must be honest and courteous.

Such a man we will start in business for himself. You can make far above average profits in the rug-cleaning business—a high-grade business all your own. Many earn $125 to $200 per week—some considerably more.

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The rug-washer finishes rugs like new on the customer's floor. Anyone can run it. Electricity does the work. A quick, thorough and highly-efficient method that restores the natural beauty of floor coverings.

There are hundreds of customers—in your vicinity and nearby towns. The business grows steadily. Simply clean a few rugs or carpets. These customers tell others and also give you their future work. Soon you will have a prosperous year-around business. Send coupon for booklet explaining everything.

"Profits Pay for Home"

Harry Hill built and paid for a home from rug-washer profits. His first day's business was $86. A. L. Miller says, "Have had rug-washer 6 years—have earned as high as $92 a day." M. O. Malmin earned 3 times the cost of his machine the first two months. Another letter says, "Made $70 in 13 hours." You, too, can enjoy a large income.

Free Book!
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Send at once (no obligation) your free booklet illustrating rug-washer and telling how I can own my own permanent business; how I can earn large profits at prices below other methods; how I can become financially independent in a short time; and how I can pay on easy terms.

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"Never a Complaint"

C. J. White says: "$100 business in six days—never a complaint." That is the nicest part of this business—every customer is more than satisfied. Stains and blotches disappear and vivid colorings and freshness in faded floor coverings come back.

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You take no risk. These machines have been manufactured since 1918 and are used by the United States Government and by many of the world's largest hotels. They are fully GUARANTEED.

EASY TERMS

The complete equipment is inexpensive. A reasonable down payment brings everything to you and the balance is paid monthly. From the start, you have your own business—one that is profitable and of which you can be proud.

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Weighs only 20 lbs—Carry on Bike or by Hand

BOYS! MEN! See how easily this 6½-year old youngster carries his MEAD CK-I KI-YAK! What fun you'll have with one—AND—you can assemble it YOURSELF at home *in only 4 evenings* from our numbered, cut-to-fit Construction Kit—and SAVE HALF the factory-built cost. No experience needed. *Thousands in use.* Tell DAD about this inexpensive educational project—and the FUN it will bring you during VACATION! Rush 10c NOW for Circulars showing 17 beautiful photos of Mead Ki-Yaks—sailing, paddling, and with motor—Low Introductory Factory-To-You Prices, $6 GIFT PADDLE OFFER.

Weighs only 50 lbs. Takes any motor 4½ hp. or less. oars and sail.

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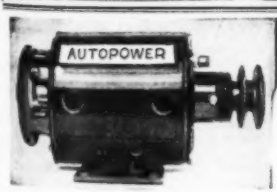

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PICTURES! Pictures! Magazine and newspaper readers demand MORE! Editors are clamoring for them! Dozens of NEW picture magazines—and thousands of other magazines, newspapers, trade papers—are paying HARD CASH for them!

How can YOU cash in on this demand? Use YOUR OWN CAMERA. You don't have to know how to take smart "angle" shots, "arty" views, or technically beautiful photographs! What editors are BUYING are pictures with news value, popular appeal, HUMAN INTEREST! Pictures you can take in your own back yard, on your own street, in your own home town.

Learn WHAT to photograph, HOW to photograph it, WHERE to SELL it, and you can "cash in"!

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York McClary, of Belvidere, O., writes: "Have received 3 checks this week. Owe you a lot for starting me on this path."

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"Have added up how much I have taken in since I sold my first picture. I have made $237.50!" Olive Hastings, Dorchester, Mass.

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How Camera Shutters Work

[*Continued from page* 113]

wide slot is used. The focal-plane shutter thus exposes a single point on the film, not the entire film, for the time of exposure for which the shutter is set. In addition to the different slots producing different speeds, it is possible to increase the tension on the spring actuating the take-up roller at the bottom of the camera. This will cause the curtain to wind up faster and the same slots to move more rapidly, producing faster shutter speeds since the film will be exposed for a shorter time. The shutters on the Graflex cameras have four small slots and six tensions, producing a combination of twenty-four shutter speeds. A fifth slot, as large as the back of the camera, is used for time exposures.

Another type of focal-plane shutter, such as is used on the National Graflex cameras, consists of two curtains so designed that with one spring tension, different speeds are produced by varying the opening between the two curtains. Most of the focal-plane shutters are made of special cloth, although a few miniature cameras have a metal shutter. Focal-plane shutters are capable of producing speeds as high as 1/1000 of a second and slightly higher in a few instances.

The focal-plane shutter, situated at the back of the camera near the film, is entirely independent of the lens and, as a matter of fact, permits lenses to be interchanged when the camera is loaded with film. With this type of shutter the container for the lens cells can be smaller. It is called a lens barrel and usually, although not always, contains the iris diaphragm leaves, hence the term "in barrel with iris diaphragm."

Since the opening in the focal-plane shutter passes just in front of the film, light from the entire lens can reach the film during the total duration of the exposure. Because of the masking of part of the lens by the leaves of the between-the-lens shutter during a portion of the exposure, tests indicate that a focal-plane shutter, when set to the same high speed, allows approximately one-third more light to reach the film. This is the basis of the claim of the one-third added efficiency of the focal-plane shutter. This added efficiency is quite necessary in speed photography when the diaphragm leaves should be closed as much as possible to increase the depth of field, and is also of importance in making any photograph when light is poor and but a very little more exposure will make a printable negative and thus save the day.

At the present time, although the focal-plane shutters of the smaller cameras can be equipped with an accessory for flash synchronization, the focal-plane shutters of the larger camera cannot be synchronized with flash lamps. It is for this reason that press and commercial photographers, in selecting a camera with a focal-plane shutter, so necessary for speed photography, also equip it with a between-the-lens shutter. This shutter additionally provides instantaneous speeds as slow as one full second. In the past, the Compur shutters without self-timer have been more satisfactorily synchronized with flash lamps. However, these accessories are now being sufficiently adjusted so that synchronization will be satisfactory in either instance.

Flying The Subway Express

[*Continued from page* 41]

that beckoning curve, thunders, another train like the one we ride, and behind us comes another, all on the same track, racing in the same direction, carrying possibly 1,000 passengers each—small cities going to work or going home at nearly mile-a-minute speed.

During the rush periods as many as 32 trains like the one we ride will slide into a station, take on and discharge passengers, and roar away again, in a single hour—less than two minutes per train. In round terms, this means that a transportation population roughly equal to that of such cities as Elgin, Illinois; or Elkhart, Indiana; or Baton Rouge, Louisiana; or Ann Arbor, Michigan; or Riverside, California; is routed over a single subway track in one hour.

Small wonder that subway schedules are far more strict than those of a transcontinental train. This tunnel through which we rush is not a dull, dark hole that concrete walls but a sentient thing which speaks in crashing echoes, talks to the motorman in a language of blinking lights, warns him of danger ahead, reaches out to trip his brakes if he ignores the signals.

We zoom into a curve and the speed of the train slackens. The motorman, who knows every inch of his run as we know our backyards, takes the curve at its critical speed limit. It is a dangerous curve, threatening derailment or a pileup into

[*Continued on page* 134]

John made $42.50 in one day in his NEW Business

● Get into this business NOW—a business which is so new that it is practically without competition. This alone should enable you to make really BIG MONEY. Hotels, homes, clubs, country estates offer tremendous possibilities. Our new DETERGER washes upholstered furniture, tapestries, all sorts of fabrics, electrically right in your customer's home, with a new soapless soap whipped into DRY suds. *No liquid touches the fabric,* therefor the furniture is ready for use soon after cleaning. We have helped hundreds of men get into business for themselves with our automatic equipment. The U. S. Government and many of the world's largest hotels use our machines.

Make Money the FIRST DAY

You are ready to go to work the minute you get the outfit, so you ought to be taking in big profits the first day. We want an honest, ambitious man in every locality. If you are that man we will help you get started for yourself in a business with tremendous possibilities.

No Rent to Pay You don't have to rent a shop. You don't have to hire a building, for you do the work right in your customer's home. You save the expense of carting furniture back and forth to a central plant; the owner's home is your workshop.

J. S. Corson says

"I cleaned seven living room sets and fourteen chairs, as well as twenty-five automobile interiors the very first month and made $279.50. "Berger Hanson wrote "My investment in your DETERGER was the wisest I have ever made. It is my most valued asset." Barrett says: "Made $28.00 in eight hours, on another job made $11.00 in two and one-half hours." Alex Gulkin's business expanded so fast that he already has six DETERGERS making money for him.

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Age ..... Occupation .....

Landing Fish Through Ice

[*Continued from page* 90]

who capture them in the fall and keep them in running water for selling. One finds little difficulty in keeping minnows alive in cold weather, even without frequently changing the water. If you must find your own, look near mouths or streams where they enter a lake and in open water at its outlet, or else cut a good-sized hole in the ice covered stream and let down a net baited with cracker crumbs or soap shavings.

Fishing holes must be at least 16 inches in diameter at their tops and enlarged and smoothed at the bottom to avoid chafing the lines. Cutting a long gash in the ice, then gradually enlarging its center, is a good method. Holes should be located 75 feet apart; fifteen "tip-ups" is the limit one man can tend, but the law will likely limit you to less. While an ice chisel is the best tool to use for chopping, a hatchet will suffice for up to 10-inch thickness. For heavier ice, a crowbar or a real stout ice chisel, made from a heavy carpenter's chisel let into a 6-foot length of iron pipe, and an axe will be required. These tools, along with a good-sized minnow pail, a screen mesh dipper to clear slush off holes and dip minnows, and fishing tackle, are all the equipment required. A small toboggan makes an easy way to tote gear along with food and drink, if you cannot drive too near the fishing-grounds.

A single correctly located hole will catch more fish than a dozen poor ones. To really catch fish, prospective fishermen should know something about their habits in order to cut holes over likely spots. Luck is usually better on mild days, and through thin ice rather than thick. Try fishing where fish were known to have been caught in the fall preceding spring. In general, perch and crappies favor weedy shallows with sand bottom; bullheads stick close to mud reefs and overhanging banks and wall-eyes and pickerel cruise about in deeper channels, preferably about submerged weed beds and sunken rock piles. If you can locate an open patch amidst weed beds, cut a hole over it and rig a "tip-up."

The size of hooks used should fit the bait as well as the fish sought after. Use No. 1 hooks for yellow perch and No. 2-0, up to even 4-0, for pike and pickerel, with or without leaders of bronzed wire or twisted gut. Twenty-five feet of line should be enough for each "tip-up" over water averaging 10 feet in depth. Use a stout grade, around 18-pound test, preferably braided, as a twisted, kinked line snaps easily when frozen. The minnow should be hooked directly behind its top or dorsal fin, and a light sinker used to keep it from loafing up under the ice. The ideal setup would be to keep the minnow a foot above bottom, but with the line shortened so as to just prevent it from reaching the weeds.

Flying The Subway Express

[*Continued from page* 132]

a concrete wall if taken too fast, so human judgment is not relied upon. If the motorman enters the curve at too high speed, a steel foot rises and clamps on his brakes.

We flash past a series of metal flags projecting from the tunnel wall outside the motorman's window. They bear the cryptic marks "R-6," "R-8," and "R-10." The control handle is shoved up and the train gathers speed again.

"R" means "resume speed," the motorman explains. When the flags appear, it is safe to push the iron horse to top speed again. The figures 6, 8, and 10 refer to the number of cars in the train. Engineers with charts and slide rules have taken such imponderables as mass and momentum and gradients and calculated to the inch the points at which it is safe for a ten- or eight-car train to pick up speed.

Every eight or ten blocks a brightly lighted platform crowded with people flashes past, but we do not stop, for we're on the inner track flying the subway express. Three yellow lights, one on top of the other, flash into view.

"Curve ahead," says the motorman, jerking his head toward the signal.

Green flashes on in the signal box just ahead—all clear in the block we are approaching. Red—and we stop until a train we do not see pulls out of the block. Yellow, and we proceed with caution. These are obvious signs which any motorist who obeys a traffic light understands. But what are these mysterious "S. B." markers which swing into view now and then and are left behind? They must be important, for they are illuminated by a powerful white light, but although our motorman watches them sharply he doesn't seem to do anything about them. You prompt him with a question and he shouts above the din:

"Section breaks."

[*Continued on page* 140]

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Novel Cigarette Automat

[*Continued from page* 71]

trick cigarette boxes, this one won't be discarded very soon because you and your friends will never get tired of having cigarettes handed to you in this novel manner.

The entire cigarette box can be made with ordinary hand tools, although a power jigsaw will simplify cutting out the bird. The drawer, cylinder end blocks and bird are all made of ½-inch stock, everything being ¼-inch stock.

First make the 7½ by 3½-inch bottom compartment, the sides of which are ¾ inch high. Set sides about ⅛ inch in from edge of bottom piece. Make main board shown in the perspective and cut slots.

The drawer is next. First drill the hole, then make parallel saw cuts for the trough, using a chisel to finish. The cigarette hopper should now be made a good fit around the drawer, yet allowing the drawer to slide freely.

Transfer the bird design to wood by means of ½-inch squares, cut out, and then taper beak to about ¼ inch at end. Cut out tail and attach.

The parts are now ready for assembling. Procure or turn a wooden cylinder 1⅜ inch in diameter by 2 inches long and on this mount the bird. This is done by cutting the heads off two six-penny finishing nails and driving them into both cylinder and bird in the manner shown. Mount cylinder in Slot "A" between end blocks shown in detail, using two nails as pivots with the heads cut off. On the under side of the cylinder glue and nail a ¼ by ½ by 2-inch strip of wood to act as a stop.

After fastening the hopper to the working board and inserting the drawer, connect the spring and cord as shown in photos 1 and 2. Now tilt birds as if to pick up cigarette. The drawer will probably come out too far and to remedy this shave off the corner of the stop and shorten the cord until drawer opens the correct distance for bird to function properly.

With this accomplished, tack the end of the cord permanently in place and fasten the working board over the bottom compartment. Decorate the bird with enamel, blue with white wings and eye-balls being a good combination if the rest of the box is done in walnut or mahogany.

Flying The Subway Express

[*Continued from page* 134]

You begin to understand. Power is taken from a third rail running alongside the track; contact shoes on the car trucks feed current to the motor. If current were fed into one end of a third rail which is some fourteen to twenty miles long, voltage would drop so tremendously that cars a few miles away would be unable to operate. Consequently the line is divided into sections, each insulated from its neighbor, each independently fed from the power house. Thus power can be cut off from any section without affecting the others.

Those S. B. markers might just as accurately be labeled "Life and Death." The white light above one of them suddenly flashes red. Instantly the motorman shuts off his power, applies his brakes.

Something has happened ahead. An emergency, possibly a short circuit. Men are working on the dead third rail, for power has been shut off from the section. Our motorman has been prompt enough to halt the train before it rolls into the dead section.

If the car had crossed the insulating break before stopping, service lights would have to be switched off instantly, leaving the train illuminated from batteries alone. Otherwise the rear contact shoes, touching the live third rail, would transfer current through the forward shoes to the dead rail which workmen are repairing and they would be electrocuted.

The very spirit of the subway is one of galvanic life, but death is forever trying to crash the turnstiles. Human ingenuity keeps the grim reaper persistently at bay. A bit wryly, the motorman demonstrates the "dead hand control" as we roll in for a stop at the first express station.

Rising up from the end of the control handle is a spring-actuated knob or button. Only when it is held in depressed position can current flow through the controller. The instant the motorman fails to hold it down, the knob flies up, shuts off the power, applies the brakes automatically. When subway trains following close on each other's heels and racing along as fast as 48 m. p. h., the dead man control prevents frightful collisions should the motorman collapse at his post.

Death in different guise rides ahead of the motorman each time he brings his train into a station. Schedules must be maintained; he does not shut off power until the first car reaches the near end of the platform. At any instant, out of the throngs of humanity packing the platform, a human

[*Continued on page* 154]

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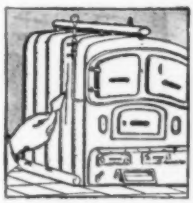
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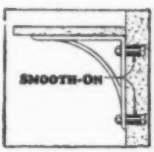

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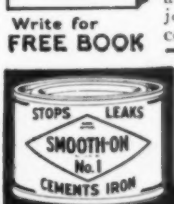

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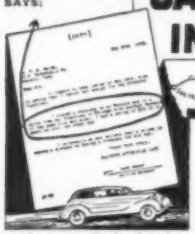

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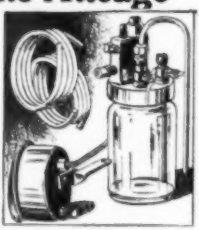

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Stamps, Rail Anniversaries

[*Continued from page* 70]

issue; the modern example, a streamliner, was shown on the higher values.

In 1936 Germany followed suit, showing its first and its then-latest locomotives on a special issue of postage. A year later, 1937, France followed suit, with the first and latest types.

Other countries have issued stamps showing railroads, thus marking (as with Nicaragua) the inauguration of new lines. Still other countries like Sweden have produced stamps to illustrate the locomotives which were used, are used, or both, in the land. Many countries have produced stamps showing early, as well as late locomotives and trains, merely as attractive designs for their issue.

Railroads and locomotives, particularly the latter, seem to be very popular as designs for postage stamps. The stamp collector who has interests along such lines will be able to form a fascinating album, displaying railroad and locomotive picturing postage adhesives!

The English "Royal Scot" locomotive illustrates a popular and fast type of steam-locomotive such as depicted on the Swedish stamps, which appeared in 1936, the 40-ore value particularly. From the photo and stamp upon it, the collector may discern the differences between the European and the American types of steam locomotive.

The story of the railroad and the development of the locomotive, as well as its spread throughout the world, is being nicely told by such stamps of the several countries issuing them. Neither England nor the United States has yet entered the lists, although the story is otherwise quite pictorially complete with the issues we already have. The 1.50 franc stamp of France (1937) shows one of the latest of the streamliners, while the San Marino 20 centesimi value pictures an electric locomotive. The Spanish stamp shown may depict the "last train from Madrid!"

MM Short-Wave Transmitter

[*Continued from page* 102]

The antenna coupling unit shown is the one actually used with this transmitter, but other arrangements may be more satisfactory with individual antennas. A single piece of wire approximately 160 feet long, including leadin, was used, and the coupling unit shown worked satisfactory. For complete information on this subject, the builder is referred to the chapter on antennas in the "Radio Amateur's Handbook."

As the set approaches completion, some builders find it almost impossible not to rush the work a little to speed up that moment when it finally can be turned on. Speeding up work is all right, but occasionally the job started as a masterpiece of good workmanship becomes "haywire." And as would be expected, more mistakes are made during this period than when the work is first started. A little extra time spent on doing a good wiring job will pay good dividends.

However, when the set is finished and ready for the test, take out a few minutes and check all the wiring. If everything is as it should be, turn on the power to the filaments. Let the 866's and the T55 burn for about thirty minutes before applying plate power.

Next, apply voltage to the oscillator. The needle of the milliammeter probably will swing over to full scale, indicating that the tank circuit is not in resonance. Turn the oscillator tank condenser (C4) until a point is reached where the needle of the milliammeter will drop sharply to about fifteen milliamperes, indicating that the circuit is in resonance. If a single loop of wire, slightly larger than the diameter of the tank coil, is connected to a flashlight bulb, and held near the tank coil, the bulb will glow when resonance is reached. If a milliammeter is not available, the flashlight bulb can be used alone as a means of checking operation.

If however, resonance is not indicated as the condenser is turned, check the wiring again. Also, the crystal may not be clean. Wash it off with carbon tetrachloride to remove any trace of grease which might have been left on the surface when it was handled.

Assuming that the oscillator stage is working, the next step is that of neutralizing the amplifier. With the T55 filament lighted, and the oscillator in operation, disconnect the positive lead of the amplifier at the power supply. Hold the loop of wire and flashlight bulb close to the amplifier tank coil and turn the tank condenser (C9) until the bulb lights brightly. Then turn the neutralizing condenser (C6) until the bulb goes out. At this point it may be necessary to retune the oscillator stage for maximum output. Then with the flashlight bulb still in position, turn C9 again until the bulb again lights. This time it may not be as bright as it was the first time. If the bulb does light, turn the

[*Continued on page* 154]

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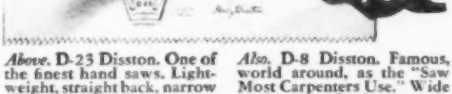

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Copying Device

[*Continued from page* 114]

tape and focus the camera on it. Adjust the angle of the light supports so that the copy is evenly illuminated and is not reflected back into the camera lens. Mark lines on the bottom batten along the sides of the light supports so that this position may be quickly arranged on future occasions without having to experiment.

The exposure on Panatomic film in such a device ranges from ⅛ to ½ second at f. 11, depending upon the tone of the print to be copied. Once the proper exposure is found, note it on the back of the print and use it in judging the exposure on future copies to be made.

When using various lenses for copying it is handy to know how to get equivalent results with different lenses and, in copying, the stop numbers on the lenses are sometimes a poor guide. A better way is to use the following procedure: Set the stop on the lens to correspond with the focal length of the lens. That is, set a lens marked f. 6.3 to f. 6.3 even if it is a lens that has an f. 4.5 opening. If you have a 10 inch lens, set it to f. 10, even if it opens to f. 8, and so on.

Now focus the camera and get the image on the ground glass the size and sharpness desired and measure with a ruler the distance from the lens to the ground glass. The reading in inches will be the actual f. value. In other words, if the distance from the lens to the ground glass is 11 inches, then the camera is operating at f. 11 and the exposure will be exactly the same as for any other lens which has been so adjusted and which measures 11 inches from lens to glass when focused. This permits the use of different lenses without sacrificing accuracy in results.

Lamp Tilts To Any Angle

[*Continued from page* 107]

covers the joint. The cover is likewise stained and shellacked.

The base is made of plaster of paris. Make a cardboard mold 4 inch square, and pour in the plaster one inch thick. In the center insert a screw 1¼ inches long, ½ inch diameter, and 20 threads to the inch. After the plaster has set give the base a coat of silver paint. Every amateur has a tilt-top attached to his camera tripod. If not, one may be obtained for a dollar. Screw the tilt-top onto the base, and force the threaded stud on the head of the ball joint in the hole in the pine block.

A bulb is inserted in the socket, and the lamp is ready for use. It can be tilted to any angle and will prove a valuable asset to any darkroom.

By using an optical instrument—the spectroscope—to investigate the chemical composition of iron, two chemists in an iron foundry can do the work that kept six chemists busy when chemical analysis of the iron was made.

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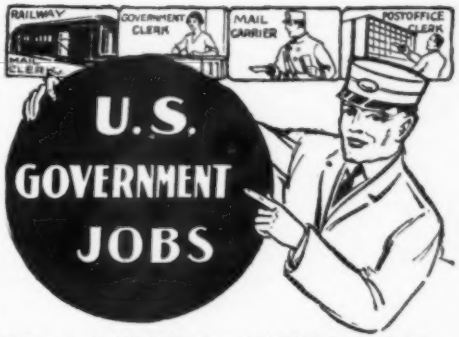

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Railway Postal Clerks get $1,900 the first year regular, being paid on the first and fifteenth of each month. ($79.17 each pay day.) Their pay is automatically increased yearly to $2,450. Advance may be had to Chief Clerk at $2,700 a year. ($112.50 each pay day.)

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Railway Postal Clerks on long runs usually work 3 days and have 3 days off duty or in the same proportion. During this off duty their pay continues just as though they were working. They travel on a pass when on business. When they grow old, they are retired with a pension.

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MM Short-Wave Transmitter

[*Continued from page* 142]

neutralizing condenser slightly until the bulb again goes out. Repeat this procedure until the bulb will not light when the amplifier tank condenser is turned from 0 to 180 degrees.

A milliammeter in the grid circuit is a more accurate method of neutralizing than the flashlight bulb. If the stage is neutralized with a flashlight bulb for rough adjustment, turning the tank condenser may cause a slight movement of the indicator pointer of the grid milliammeter. If this occurs, turn the neutralizing condenser slightly. Turn the tank condenser again and watch the meter for needle movement. Continue to adjust the neutralizing condenser until C9 can be turned without having an affect on the meter.

After the tube is neutralized as completely as possible, replace the positive high voltage lead removed before the neutralizing process was started, and turn on the power. Full voltage should not be applied to the amplifier until it is tuned to resonance and a dummy antenna is connected.

When power is first applied, place the bleeder tap at a point where approximately 600-700 volts will be obtained. When the tank condenser is turned, the milliammeter will show a sharp drop when resonance is reached. If a flashlight bulb and loop of wire is used with the amplifier, do not hold it too close to the tank coil or the bulb will burn out. When the stage is tuned, connect a dummy antenna for final testing with full plate voltage. Do not use high voltage unless a load is provided for taking up the excess of r. f. power available. If full voltage is used when there is no dummy antenna connected, the tank or neutralizing condensers may arc over.

When the set is operating in a satisfactory manner, listen in to its signal with a receiver or a monitor. If the receiver is located in the next room and the antenna and ground disconnected, no difficulty should be experienced in tuning in a sharp signal. Of first importance on the subject of testing this or any other transmitter: DO NOT TEST WITH AN ANTENNA CONNECTED.

On-the-air testing is nuisance number one to any listener. Always use the dummy load for this purpose. The results obtained are just as good as with the antenna, and it does not clutter up the air with unnecessary signals.

With approximately 400 volts on the plate of the 6L6, the grid meter should show approximately 18 milliamperes. The plate milliammeter should indicate between 40 to 60 milliamperes under load. The T55 can be loaded to draw not more than 150 milliamperes. With approximately 1,200 volts on the plate, the output will be about 140 watts, assuming that the stage is operating at 75 per cent efficiency.

Under no-load conditions, the builder may notice that the tank coil becomes quite warm. However, when a load is applied, this condition almost entirely disappears.

In crowded neighborhoods, probably the greatest potential source of trouble with nearby receivers is that of "key click." This usually can be eliminated by installing a "key clip filter." Several suitable types will be found in the "Radio Amateur's Handbook."

The builder will find tuning considerably more satisfactory if insulating flexible couplers are attached to each condenser tuning shaft and the dials attached to insulating rods. This completely eliminates any possible body capacity affect and also the danger of shocks or burns. Although the power supply is capable of causing severe and sometimes dangerous shocks if touched accidentally, the condensers also cause severe burns. Serious shocks from this source also are possible, i. e. one hand on the grounded chasis and the other touching the rotor of the condenser.

When an antenna is connected, the amplifier plate current should rise from four to six times its minimum reading. Never load the amplifier tube to the point where its plate shows color, that is, a red tint. Although the input may indicate plenty of output, the tube life will be exceedingly short.

When turning on the transmitter, always permit the filaments to burn a minute or two before plate power is applied. This holds true particularly for the 866's and the T55.

Although only one power supply diagram is shown, a suitable supply for the oscillator is described on page 102 of the December issue of MODERN MECHANIX. If the builder prefers to use the 1,200-volt supply for both stages, the 400-volt tap shown in dotted lines in the diagram should be connected to the 400-volt connection at the set. When separate power supplies are used, the negative terminals should be connected together. Separate supplies are recommended because they give the oscillator more complete isolation from the succeeding stages.

Coil dimensions for the 80-meter band are as follows:

L4—27 turns No. 20 D. S. C. wound to cover length of one and one-half inches.

L5—26 turns No. 16 D. C. C. close wound.

L6—26 turns No. 14 enamel wound to cover a five-inch space.

Flying The Subway Express

[*Continued from page* 140]

figure bent on self-destruction may leap to the tracks. The motorman hasn't a chance on earth of stopping his train within two car lengths, even with full air power applied.

Every few weeks somebody elects this form of suicide. They do not always succeed, for in busy stations a deep trough is cut between the tracks and many persons have landed in it while the train passed over them harmlessly. But the jumper is the black dread of the motorman. There is nothing he can do about it. The law of averages makes it certain that sooner or later a suicide will select *his train* to end his life. When the event occurs, the motorman finishes his run, just as an airplane pilot goes up immediately after a crash. The subway must go on.

Oddly enough, the motorman is the one man a subway passenger almost never sees. Often he does see the guard who controls the electropneumatic car doors. But as he tools his string of heavy steel cars through the tunnel, the motorman himself is watched. Like the towers erected along surface railroads, the subway has its control stations at express stops where miniature tracks of the subway section show the movement of trains.

As each train moves along it actuates colored lights which flicker on along the toy tracks to show its progress. At any time the towerman knows the exact position of trains in his section, and he hands out orders in event of emergency.

For a single five-cent investment you can ride the subway as long as life remains in you, and life itself can be sustained at the confection stands and lunch counters which will be found inside the turnstiles and at the route terminals. You can telephone, buy magazines, newspapers, flowers, go to theatres and enter shops and department stores, all without going aboveground.

Subway rolling stock, driven constantly at top speed, is regularly inspected and goes to the shops for periodic overhauls. Much repair work can be done by simply rolling the cars over pits and working from beneath, but just as often it is necessary to lift the massive steel body entirely off its trucks. This is done by 25-ton steel cranes which lift off the body and set it on jacks while the wheels are rolled into the truck shops. Usually repairs are made and the car put back into service within twenty-four hours. Cars in the shops earn no nickels, and the I.R.T. must keep 2,118 cars in daily operation, the Independent subway, 1,162. The average run of a motorman is 100 miles a day.

For the motorman, of course, his run is work, but he derives from it the satisfaction which comes to any railroad man. In many respects the job of the subway trainman is more complex than that of the engineer of a crack transcontinental flyer, and in a single day he carries more passengers that the flyer does in a year.

For the passenger who gets up in the nose of the first car, lets the breeze tear through his hair and watches the tunnel unroll its light-spattered mysteries, a ride on the subway scenic railway is one of the most thrilling experiences of the big city.

Defective Welds Detected By "Magnetic Eye"

A "magnetic eye" which can see into metals and detect welds has been developed by Professor W. B. Kouwenhoven of Johns Hopkins University and A. E. Vivell of Princeton University.

The "eye" is based on principles of magnetism. The welded seam is magnetized by a powerful alternating magnetomotive force. For welds less than one-quarter-inch thick, 60 cycle current insures penetration of the magnetic flux. Two search coils connected in opposition are placed on the seam so that any stray field which may be present cuts their windings. The shape of the wave of electromotive force induced in the coils is then observed by means of an oscillograph.

It is claimed for conditioned air that it reduces the number of heat prostrations in summer and the number of colds in winter.

A new apparatus for medical use makes it possible to transmit heart beats by wireless and to record them like a graphophone record.

Germany has a reserve of lignite in the lower Rhine region estimated at fifteen billions of tons.